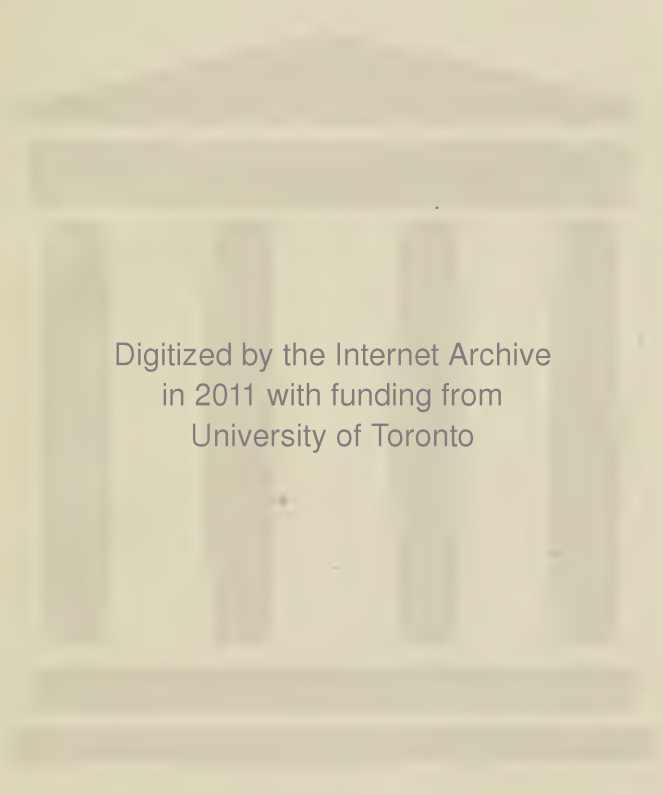






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JOURNAL
OF
THE FRANKLIN INSTITUTE
OF THE
State of Pennsylvania
AND
AMERICAN REPERTORY,
OF
MECHANICAL AND PHYSICAL SCIENCE,
CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,
AND OF
AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
BY THOMAS P. JONES, M. D.,

Mem. of the Am. Philos. Soc.; of the Acad. of Nat. Sci., Philad.; the Am. Acad. of Arts and Sci., Mass.
the Nat. Inst. for Promotion of Sci., Washington, &c. &c. &c.

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JOURNAL
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JULY, 1844.

CIVIL ENGINEERING.

Screw Pile Pier, proposed by Lieut. EMORY, Top. Eng., for an Ice Fender at Newcastle, Delaware. Communicated, with the Drawings, for the Journal of the Franklin Institute.

Col. J. J. ABERT, Chief of the Corps of Top. Engs.

Sir,—In the fall of 1840, I submitted, through Major Hartman Bache, to the Bureau, a plan for the improvement of the harbor of Newcastle, in which it was proposed to use iron piles, secured by "Mitchell's Patent Mooring Screw," to form obstructions to the running ice.

This plan, it was believed, would effectually accomplish the desirable object of securing the harbor from the effects of ice without producing the evil heretofore encountered of retarding the passage of the water so much as to cause deposits of mud. The details of the plan, were, of course, imperfect. By the experience of Capt. Swift, and my own reflections, these have been much improved, and I herewith submit a sheet containing drawings of them, see Plate I.

The manner of attaching the collars and braces, is the same as that used by Capt. Swift, in the construction of the Black Rock Beacon. No change is proposed in the general plan, except to substitute a pier consisting of five iron piles, instead of nine, in one particular locality; that is, between the long wharf, and the southern unfinished pier.

This modification is made because this position is less exposed than

the others, and it is believed five piles are amply sufficient to resist any mass of ice that can come between the wharf and the pier.

It is not considered necessary to revise the estimates heretofore made, as the modifications proposed extend only to details involving no additional expense. I have the honor to be

Your most obt. servt.,
(Signed) W. H. EMORY,
1st Lieut. Top. Eng.

Topographical Bureau, May 20, 1844.

Explanations of Plate I.—Fig. 1, elevation of the pier; fig. 2, plan of braces and collars; fig. 3, top view of centre collars for braces; fig. 4, side view of centre collars for braces; fig. 5, top view of outside collars for braces; fig. 6, side view of outside collars for braces; fig. 7, mooring shackle *enlarged*; fig. 8, collar for mooring shackle; fig. 9, pile head; fig. 10, nut for pile head.

a, mooring shackle; *b*, collar for mooring shackle; *c*, covering plate; *d*, braces; *e*, outside view; *f*, inside view; *g*, Mitchell's screw.

The following detailed description of Mitchell's mooring screw, and its application to the construction of the Wyre light-house, was prepared for publication before our receipt of the foregoing article, and may be considered as an appropriate appendix to it: COM. PUB.

Description of Mr. Mitchell's Patent Screw Mooring, as being now laid down in the Port of London. By J. ELMES, Esq., Surveyor.

This sort of mooring is constructed, as its name implies, on the principle of the screw, but differing essentially in form from that well known instrument; for while the spiral thread makes little more than one turn round its shaft, it is, at the same time, extended to a very broad flanch, the hold which it takes of the ground being proportional with its breadth of disk.

Where it is necessary to provide against a very heavy strain, Mr. Mitchell has moorings of 3 feet 6 inches diameter, and the principle is capable of still further extension.

A mooring of the above diameter presents a resisting surface equal to about ten square feet; whereas the palm of the largest anchor in the British navy does not exceed half that size; and some estimate of its holding powers may be formed, when it is shown that this broad surface can be screwed to a depth many times greater than that to which the palm of an anchor can ever descend.

The method of laying down the mooring is briefly thus:—A strong mooring chain being so attached to it as to allow the screw to turn freely, without carrying the chain round with it, a powerful iron shaft is then fixed firmly in the upper part of the mooring, which is formed square for that purpose, setting in the same manner as a key to a harp, or piano forte, in winding up; it is then lowered by the mooring chain, joint after joint being added to the shaft till the mooring has reached the ground; light levers of 12 feet in length are then applied to the shaft in the manner of a capstan, when the operation of screwing the mooring into the ground commences.

Two boats, or barges, having been moored firmly, head and stern, close alongside each other, and the upright shaft rising between them about midships, the men place themselves at the bars, and move round from one boat to the other, the two giving them a safe and convenient platform; by a simple contrivance the levers are occasionally shipped upwards, as the screw and shaft sink into the ground.

When the number of men employed can no longer force the screw round, the levers are removed, and the shaft drawn out of the ground, leaving the mooring firmly imbedded with the chain attached to it; a buoy being shackled to the other end of the chain the work is completed, the time required for the whole operation seldom exceeding a few hours.

Fig. 11, Plate I, shows the screw mooring, as prepared for use. *a*, is a spiral, or screw, flanch of about one turn and a half, having a hollow cylindrical centre, as shown in fig. 12, and of cast-iron in one piece; *b*, is a wrought-iron spindle, which passes through the cylindrical socket of the screw flanch, somewhat tapering in form, as shown in fig. 13, and when driven up tight, is fixed thereto by a forelock, which passes through both; it is formed with a square head, *c*, to receive the key for screwing it into the ground; *d*, is a collar of wrought-iron, the front of which is shown in fig. 14, fitted so as to turn freely on the upper part of the shaft of the spindle below the collar. Fig. 12, shows the upper surface of the spiral flanch; fig. 13, the spindle; and fig. 14, the collar and shackle. The shackle is fixed to the spindle by means of the loose collar, in order to prevent the dragging round, and the consequent fouling of the chain, whilst the spindle is being turned in, or out, of the ground.

Civ. Eng. & Arch. Journ.

Description and Structure of the Wyre (Seaward) Lighthouse, leading to Port Fleetwood. By Com. H. M. DENHAM, R.N., F.R.S.

It was my study, when planning this navigation, to identify the remotest spit of bank turning into it, without subjecting the mariner to the treacherous, and, at best, but partially lighting agent, a *Light Vessel*; Messrs. Alexander Mitchell & Son, of Belfast, readily took up the proposition, and the Board of Directors of the railway and harbor project, as readily adopted the application of Mitchell's ingenious mooring screw to the insertion and basing of piles, or pillars, in sub-marine foundation. I had given much trouble to Messrs. Mitchell, when unavailingly submitting their plans and specifications to the Liverpool Dock Company, (Oct. 4, 1838,) of so perfect a mode of establishing lights *out upon the very* banks of a navigation, whereby the power and object of a light-house is enhanced by proximity with the anxious observer from sea. In fact, a light-house can be thus erected upon any *under-water* spit, as indifferent to a 30 feet rise of tide and channel surge, whilst sending forth its light of the same character and stability, as if on the main land; thereby throwing it more intensely and effectively *on the region required*, especially where

shoals out-lie the main to any extent. Its time in erection is the shortest possible,* and it is of so portable a structure, that it may be removed, if local changes require, to another site in a month. Wherefore, then, should not every spit, now guarded by a light vessel, with her unavoidably inferior order of lights, rendered more so in a gale of wind by pitching, floundering about, and ever and anon submerged in the trough of sea, spray, and spoon-drift, and that too when most wanted, and often at the very crisis of exigency to all around, *breaking adrift?* Wherefore not supersede them by so purpose-like a fabric? Let those who take interest, but who doubt, or cannot conceive, the matter, go to Fleetwoot Mount Observatory, commanding the mouth of the Wyre, and watch the effects of a westerly gale upon the first of its kind, (not associating the effects of a sea-way upon the Eddystone, or Bell Rock, for the screw-piled pillars *do not oppose* the sea.) A structure destined to save many a gallant bark, that would otherwise drive, unbeaconed and unwarned, upon the sands of Morecambe Bay, and I doubt not will give rise to a general adoption; whilst rendering it imperative on local guardians of a navigation, to establish *refuges* for the cast-away mariner, on the isolated banks; since, by this method, the practicability is manifested. Indeed, this sub-marine method of commanding foundation and *hold-fast*, so ingeniously contrived by Messrs. Mitchell, combines the vital essentials to the seaman's hope, of *warning, guiding, succoring*, and, when in port, *securing!* The figure of this first "screw-pile" light-house in the United Kingdom—in the world, I may say,—is shown in Plate II, and presents to the eye a well proportioned group of columns rising out of the sea, in the intervening and over lapping order that hexagonal, or six angled, figures produce, according to the separate angles you may be opposite to; a systematic interlacing of tension rods renders the fabric sufficiently opaque, even below the platform; but above the platform, of 27 feet diameter, you have a six angled dwelling house of 20 feet diameter, by 9 feet high; on the centre of which rises the 12 sided lantern, with Chinese roof, of 10 feet diameter. Thus, you have a figure of 46 feet spread at the base, contracting at the platform balcony to 27 feet, and elevated 45 above low water level; surmounted, as stated, by a bulky, yet pleasing and effective, superstructure, comprising a comfortable residence for the light-keepers, whilst affording you a steady, bright, *uniform* light, 45 feet above the mean sea level, ranging over an eight mile horizon, visible 10 miles from a coaster's deck, and freed from those *breaks* of brilliancy attending the offing passage from reflector to reflector, by being fitted with a light of "*Dioptric*" order. Foggy periods are provided for by a self-acting deep sounding bell, tolling three strokes of five second intervals, at one minute pauses; and tide time for vessels of 12 feet draft, is denoted by two black balls being kept upon its flag-staff, until 12 feet ceases upon the *straight course, right up*; at the same time, however, denoting 17 feet up through the *buoyed* channel.

* The Wyre Light-house was reared in two of the shortest day months in the year, not affording *daylight* during a low water period, spring tides, but depending on flambeaus, or moonlight.



Specification of the above Screw Pile Light-house, erected on the north-eastern low water spit of North Wharf Bank, at the entrance of the Wyre Navigation, the structure being supported upon, and secured to, the bank with Mitchell's Patent Screw Piles of three feet diameter.

The foundation of the building is formed of seven screw piles, six of which are the angles of a hexagon, about 46 feet in diameter, and the seventh pile stands in the centre of the figure.

The heads of all the outer piles have an inclination inwards, by which the diameter of the frame work connecting the top of the columns, and upon which the house stands, is contracted to about 27 ft. Each screw pile is formed of a malleable iron shaft 15 ft. long, and 5 ins. diameter.

On each pile a 3 foot screw is firmly keyed near its lower extremity, beneath which is placed a large drill, or opening, bit.

At the upper end of the shaft is a screw of 18 ins. long, and 2 ins. diameter, for drawing down and screwing the wooden column to the iron pile, which latter stands about 5 ft. out of the ground.

The columns are thus prepared,—seven logs of Baltic timber are selected, of the largest and best quality; the centre one is 56 feet in length, all the others are 46.

The pedestals rise about a third of their height, and the remainder of the shafts are rounded, both for appearance and as lessening any vibration from the action of the sea.

An opening in the lower end of each column is then made of 5 ins. diameter, and to the depth of about 8 feet, by boring in the manner of a water pipe; strong iron hoops are then driven upon it, hot, the first about 8 feet up, the second about 4 feet, and the third at its lower extremity.

This hooping will give to the column greater strength than it originally possessed, especially as the wood removed by boring is the weakest in the tree, and adds scarcely any thing to its actual strength.

The column being raised perpendicularly above the iron pile, the end of the latter is introduced into the opening prepared for it, and which has been made to fit accurately upon it; when the top of the pile has reached the end of the cavity, screwing on (by capstan,) the foot of the column will be inserted in the bank about 3 feet; the wood, when wet, will clasp firmly on the iron, but, as an additional security, the internal screw attaches the two together.

The framing upon which the house stands is firmly secured round the centre column, and to the heads of the outer ones, by means of cast-iron capitals let down over the heads of the columns, the capitals being cast hollow for the purpose; to the abacus of these the top framing is secured with screw bolts passing down through the wood and iron, having nuts on the under side, all boring, or cutting, into the main support of the building being thus avoided, and the adjacent parts of the framing are bound together by wrought-iron straps and knees; the beams which radiate from the centre to the heads of the outer columns are 12 ins. deep by 7 ins. wide, and those which connect the head of the outer columns 12 ins. by 4.

To give lateral strength to the building to resist the effect of heavy bodies drifting against it, twenty-four angle braces from round iron of $1\frac{1}{4}$ inch diameter are applied, as shown in the plan, by which a resisting power equal, at least, to 350 tons, is presented in every direction; these braces are secured at the top to trusses cast with the capitals, and beneath to strong wrought-iron bands with projecting bolt holes; by these means boring into the columns is again avoided; the braces are keyed up at their crossing, as shown in the plan.

The light-keepers' house, which is hexagonal, is in diameter from angle to angle 22 feet, and 9 feet in height.

The centre column rises to the base of the lantern, which, with the roof, it assists to support, giving great additional stability to the whole structure.

The corner posts of the house are 7 ins. by 6, all remaining studs 6 ins. by 4, beams of roof 9 ins. by 5, and all outside planking, together with floor and roof of house, is 2 ins. thick.

The house has an outside door and three windows, and is divided into two apartments, one having a fire place and the floor tiled; the walls and ceiling of both apartments are lathed and stuccoed.

The lantern, which is 12 sided, is 10 feet in diameter, and in height to the top of the windows 8 feet, by which the lights are raised above the highest spring tide level about 31 feet, or $44\frac{1}{2}$ above half tide level.

The lights (in this case of dioptric order) show throughout the periphery, and the roof is covered with strong sheet-iron, (a lightning repeller and conductor, of course.)

The light-keepers' house is covered with sheet-lead, and a light iron railing is carried round the top of the building and the platform.

London, Jan. 31, 1840.

HENRY MANGLES DENHAM.

Explanation of Plate II.—A, marl formation; the screws are 10 feet below low water mark; B, sub-stratum of sand; C, low water equinoctial springs; D, low water ordinary tides, 2 feet above ditto; E, low water neap tides, 9 feet above ditto; F, half tide level, 15 feet above ditto; G, high water neaps, 21 feet above ditto; H, high water ordinary tides, 28 feet above ditto; J, high water equinoctial springs, 30 feet above ditto; K, underside of platform, 45 feet above ditto; centre of the dioptric light in lantern, 60 feet above ditto. Ibid.

*On the Pyramids of Egypt.** By J. J. SCOLLS, Esq., F.R.I.B.A.

About three years since the two first parts of the magnificent work of Colonel Vyse, on the Pyramids of Egypt, were presented to the Institute, and Mr. Scoles then read a paper on the subject of the discoveries made by Colonel Vyse, and described the pyramids at Ghizeh. On the presentation of the concluding number of the work, he took the opportunity, on the last meeting of the Institute, to resume the subject, and to describe the further discoveries which have been made

* Read at the Royal Institute of British Architects.

Fig 1.

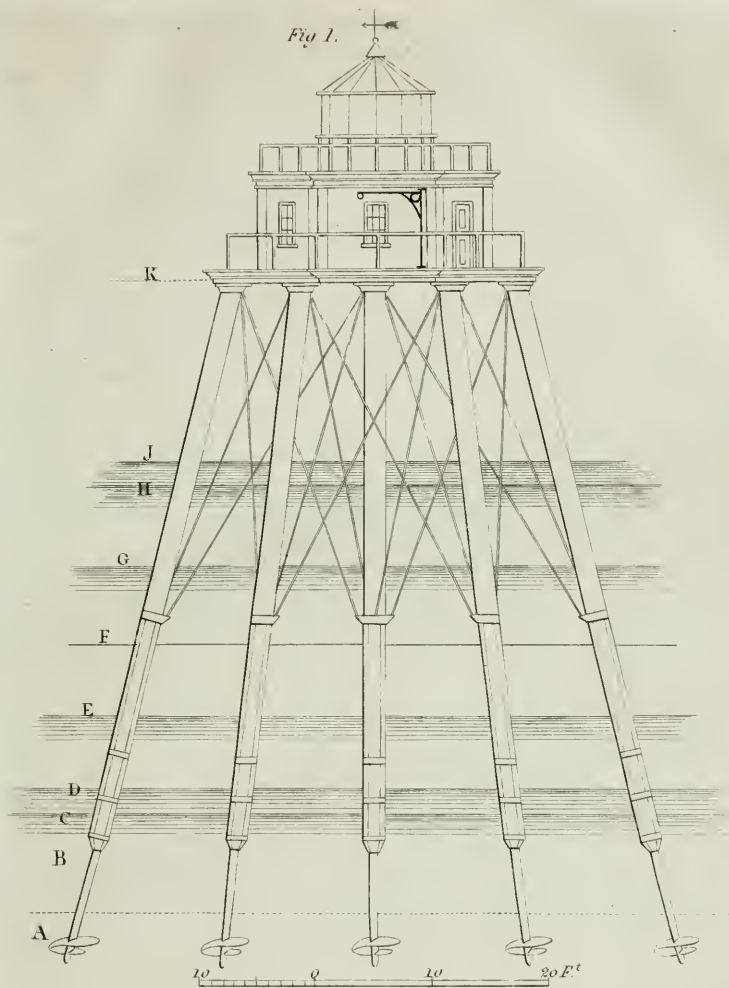


Fig. 4.

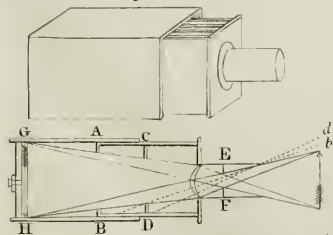


Fig. 3.

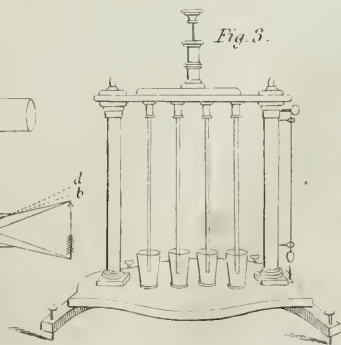
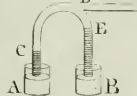


Fig. 2.





in the pyramids situated at Sakkarah, Dashhour, and other places in the "Faïoum;" and which are delineated in the third number from drawings by Mr. Perring, the civil engineer, under whose direction the various excavations were made at the expense of the gallant Colonel.

There appear to be thirty-nine pyramids in Middle and Lower Egypt, all of which have been explored by Mr. Perring. They are situate on the western side of the Nile, chiefly on the desert hills, occupying a space, measuring from north to south, of fifty-three English miles.

The first pyramid described by Col. Vyse, is known by the name of *Abou Roash*; the base is 320 ft. square. The bulk of it is built of the mountain rock, (a sort of hard chalk) which has been reduced to a level around it, and the defective places have been made good with masonry. No part of the external casing is to be found; indeed, the edifice was not probably ever completed, or raised to a considerable height. A passage about 160 ft. long, commencing on the north, and descending at an angle of $22^{\circ} 35'$, leads to an apartment about 40 ft. by 15 ft.; above it smaller chambers appear to have been constructed similar to those in the king's chamber in the great pyramid of Ghizeh, called "Chambers of Construction," because they relieve the lower part from the superincumbent weight. Near to the pyramid are heaps of broken granite, which may be the chips of the blocks for the extreme casing; the blocks themselves, probably, have been re-used in modern times, as the pyramids have been a sort of quarry for ages past. The fragments, though granite, crumble to pieces upon being handled, and are much decomposed, either from great antiquity, or from an exposure, not merely to the corroding air of the desert, but also to the moist winds of the Delta. The common saying, that it never rains in Egypt, only applies to the upper country. In the Delta, extending from the sea to the district of the pyramids, rain is frequent and copious, and it was noticed that persons have arrived at Alexandria, and remained there some time, subject to continual rain, and have left with the impression that it always rained in Egypt, although their idea before visiting the country was, that there it never rained.

The next pyramid is situate at *Rhegah*. Mr. Scoles here remarked that the names given to the pyramids, and by which they are known, are derived from the villages nearest these monuments, and have no reference to their ancient names, though frequently the site of an ancient city is to be traced in the modern name of the villages in the vicinity. This pyramid of Rhegah is curious, on account of being carried up in two inclines, like a pyramid at Dashhour. Mr. Perring did not succeed in discovering any entrance to it; but in the course of his excavation he discovered fragments of stone sculptured and colored, and some marked with golden stars upon a dark blue ground, as if belonging to the ceiling of an apartment.

At *Abouseer* are five pyramids, some tolerably perfect; Mr. Perring experienced great difficulty in exploring the interiors, as large masses of rubble masonry constantly fell in, and seriously injured

some of the explorers. The interiors of three of these pyramids are similar in their arrangement. The entrance passages leading from the centre of the northern fronts, are at first inclined, and afterwards horizontal. The apartments in the centre, range from east to west, and are covered by inclined roofs, formed of several courses of stones. The bulk of the northern building has been, in the first instance, carried up in degrees, or steps, and afterwards completed in the pyramidal form. The masonry, in general, is very rude, consisting of rough blocks of various sizes put together like rubble work with *Nile earth*, instead of mortar. The passages are lined with granite, and were closed by portcullis of granite; this material was apparently introduced to give strength to the masonry where its solidity was weakened by passages, &c., and, as an additional security, there had been three tiers of roof blocks over the chamber, and the base of the upper tier had been carried beyond those of the lower, in order to distribute the pressure over as great a base as possible. These blocks were of immense size, some 45 ft. long, 9 ft. wide, and 12 ft. thick, and yet so completely had they been destroyed by the indefatigable exertions of the people who broke into these pyramids, that only two perfect blocks, and fragments of two others remain. The marks of wedges were every way visible, but Mr. Perring observes, it is difficult to imagine any power but that of gunpowder could have effected so much destruction. A recess in the casing above the entrance appears to have been intended to receive an inscription like that, as we are informed by Diodorus, was placed over the entrance of the third pyramid of Ghizeh; and this circumstance may account for the inscription, said by Herodotus, and by other authors, to have been seen upon the great pyramids. In one of the Abouseer pyramids blocks of granite filled up the entrance passage, and remained in their original positions, clearly proving that the interior of the pyramids was not intended for any astronomical purposes. The pyramids of Ghizeh had the passages similarly filled up, and the violators of these monuments of the dead, had, in the first instances, forced a way down to the chambers through the solid masonry.

The larger of these Abouseer pyramids was built in steps, or degrees, covered over with flat stones, and the space between these and the pyramidal casing was perhaps filled up with a rubble work of smaller stones. The mortar used in this pyramid was composed of Nile earth mixed with a small quantity of lime, or pounded limestone. In this pyramid we have a specimen of the durability of wood, for a long piece of this material had been worked into the masonry, which, though rather shaly, was completely sound, and must have been built in the masonry at the time of the original erection of the building, a considerable portion of the same still remaining inclosed among the stones that have not been disturbed, and the mortar adhering to its surface, which could only have taken place when it was first laid on. A portion of this very piece of wood is in the British Museum. In the smaller pyramid the apartment was 12 ft. 2 ins. long, and 10 ft. 6 ins. wide; the roof was covered with blocks laid horizontally, and which had given way.

At Sakkarah are eleven pyramids, and a large building called the Throne of Pharaoh. They are built of stone, and are much decayed, except the large one, which is built in degrees, and this and another towards the north-east are the only two at present open. Mr. Perring has given a sketch of these pyramids, and that gentleman remarks, that Bruce probably alluded to this view, when he observed that "the traveler is lost in the immense expanse of desert, which he sees full of pyramids before him—is struck with terror at the unusual scene of vastness, and shrinks from attempting any new discovery among the moving sands of Sakkarah." In the second pyramid the regular inclined passage in the centre of the northern front remains closed up with masonry. The two apartments have pointed roofs, the blocks which form the sides are not laid in horizontal beds, but are laid on an inclined plane like the beds of the queen's chamber in the great pyramid of Ghizeh.

The great pyramid of Sakkarah is called, by the Arabs, Haram el Modarrgeh, "The Pyramid of Degrees." It is evident that the exterior of the edifice originally consisted of six degrees, or stories, varying in height, and gradually diminishing in height towards the top, each of which had the shape of a truncated pyramid, and was successively smaller than that below it; but by the effect of time and violence, the whole of the eastern, and nearly the whole of the northern and of the southern sides of the lowest tier have been removed. Two attempts have also been made to force an entrance on the southern side, and the French are said to have employed artillery for the purpose. The bulk of the masonry consists of loose rubble work, and is inclosed by walls about 9 feet in thickness, and are composed of rudely squared stones set to the angle of the face; and the breadth of the building from north to south, has, apparently, been increased by an additional wall on each of these sides. The walls of the lowest tier are 10 feet thick. The mortar is of various kinds, but it is principally composed of the gravel of the desert, and of lime, or of Nile earth, and of small pieces of calcareous stone. The face of each story has an angle of $73^{\circ} 30'$ with the horizon. The entrance is in a pit which opens into a passage partly horizontal, and partly inclined, leading to the lower part of the large apartment. Near the entrance of the passage is a hole for the pivot of a door. Another passage from the northern front leads to the same apartment at 7 ft. 6 inches above the floor. A third entrance from the same front communicates with a recess in the upper part of the apartment. A fourth entrance proceeding from a pit on the southern side, communicates by a horizontal gallery with another recess 70 feet above the floor of the apartment. The gallery is an excavation, but as the rock above it was not of sufficient thickness to sustain the weight of the superincumbent masonry, the ceiling is supported by a row of 22 short columns formed with blocks of compact limestone. The columns have been brought to their bearings by wedges of wood. The southern end of this gallery did not seem to have been previously visited, as nearly 30 mummies were found in it apparently undisturbed. They had neither coffins, or sarcophagi, but three, or four, had painted decorations;

they were enclosed in wrappers with pitch and bitumen: but as Mr. Perring did not meet with any of the objects usually deposited with mummies, excepting some of the common stone idols on the body of a female, he, therefore, concluded they were the bodies of persons employed on the building.

A large apartment, measuring 24 feet by 23 feet, and 77 feet high, is an excavation. The original ceiling was examined by the help of torches made of greased rags, and ascertained to have been formed with planks, supported by a platform of timber, consisting of cross bearers of oak, larch, and cedar, and of two principal beams of oak about 18 by 12, and strutted from each side by angle pieces. The larch was in the soundest state. Beneath the floor of this large apartment, which consists of blocks of granite 3 ft. 6 ins. to 4 ft. 6 ins. in thickness, a remarkable chamber 10 ft. long, 5 ft. 4 ins. wide, and 5 ft. 4 ins. high had been formed; the entrance to it had been closed by a conical block of granite shaped like the stopper of a bottle, above four tons weight.

The Baron von Minutoli supposes this chamber to have been the place of an oracle; but Mr. Perring is of opinion the place was intended for a treasury, because there did not appear any secret entrance by which a man could easily have got into it, and because the ponderous block by which it was closed did not seem fitted for mysterious purposes, as a number of men, and machinery also, would be required to raise it; because, likewise, no acoustic effect was perceived which would peculiarly qualify the place for an oracle.

The floor of the large apartment was supported by pillars of loose masonry wedged up with wood to an uniform height; broken pieces of wood, crooked branches, &c., have been inserted between the pillars to tie them together. The extensive employment of wood is peculiar to this pyramid. There are other smaller apartments in this pyramid. The doorway in one of them is bordered with hieroglyphics in relief, and small stars in relief are sculptured on the headings of this and another doorway.

The sides of some of the apartments are ornamented with rows of convex pieces of bluish-green porcelain about 6 inches by 4½ inches, inscribed on the back with a hieroglyphic, the impression of which remained on the cement. The porcelain had been removed. At the back of each piece of porcelain was a projection pierced through with a hole, into which the moist stucco upon the wall entered, (the stucco was composed principally of plaster of Paris,) in some instances, to increase the adhesion, the wall was also perforated in the same manner. This pyramid differs from the rest in many respects. It is the only one in Egypt the sides of which do not exactly face the cardinal points, the northern front being 4° 35' east of the true north. It differs in the form and mode of building, in the number and complexity of the passages and apartments, having four entrances, one being on the southern side; by the hieroglyphics, and peculiar ornaments on the walls of the chambers, and also in containing a large apartment covered with timber. The remaining pyramids at Sakkarah are very much ruined, and have not any peculiar arrangements, or con-

struction, to require particular notice. The Throne of Pharaoh, so called from an Arabian tradition that an ancient king of Egypt erected it for his seat, is a pyramidal building, composed of very large stones, and constructed in two degrees, or stories. The materials consist of coarse calcareous stones, in which are semi-petrified oyster shells. The building, has, no doubt, been a tomb, but no entrance has been discovered.

At Dashhour are three pyramids of stone, and two of crude brick. The north stone pyramid is the most perfect of any in this district. The stones are laid in horizontal courses, and the masonry is good; the angle at the apex is nearly a right angle, and the building has, on that account, a handsome and solid appearance. The usual inclined passage leads to the chambers about 12 ft. wide, which are covered over by the courses of the walls over sailing about 6 ins. on each side, leaving the ceiling 1 ft. 2 ins. in width.

The southern stone pyramid is built in two inclinations, so that the lower part has the form of a truncated, and the upper that of a perfect pyramid, which mode of construction, according to Sir Gardner Wilkinson, was probably occasioned by a desire to complete the building more quickly than it was first intended: this conjecture was, in some degree, confirmed by Mr. Perring's researches, by which it appeared that the upper part had been carried up with less care than the lower, and was also composed of smaller stones; but whatever may have been the cause, all architects must agree with Mr. Perring, that the effect is unpleasant, and very inferior to that of the other regular formed pyramids. The beds of the casing stones are not horizontal, but incline downwards towards the interior of the edifice, in order, probably, to obtain greater solidity, as likewise to save the materials, as less of the external faces of the stones thus laid would require to be worked away to complete the exterior of the building. This inclination, however, is not uniform, nor at right angles to the exterior, but it seems to be regulated by the shape of the blocks. The usual inclined passage leads to several chambers, which are covered by the side courses approaching each other.

The northern brick pyramid is composed of crude bricks 16 ins. long, 8 ins. wide, and from $4\frac{1}{2}$ ins. to $5\frac{1}{2}$ ins. thick, some composed of alluvial soil, some of sandy loam mixed up with Nile earth, and a little straw. All the bricks are remarkably solid, laid principally in courses from north to south, occasionally intersected by courses from east to west. The bricks were bedded in, and the interstices between them were filled in with fine dry sand. The bricks were marked on the upper surface, by means of the fingers, with different signs, apparently according to their quality, and also according to their position. The most usual mark had been made by two fingers about 1 inch apart, having been drawn down the middle. This building was cased with stone, and it was supposed that stone might have been also employed in their interior for the construction of the apartments, or that the interior might afford additional proof of the antiquity of the arch, because ceilings to any extent could not have been formed with bricks in any other manner; but with all Mr. Perring's excavations and researches, he could not discover any entrance, or apartments,

within, but he discovered a very curious and interesting mode of forming a foundation. It seems that the stony surface of the desert had been made level by a layer of fine sand, and confined on all sides by a stone platform 14 ft. 6 ins. wide, and 2 ft. 9 ins. thick, which supported the external casing, and the pyramid was built upon the sand, which is firm and solid. Mr. Perring has met with many other instances in Egypt where sand had been thus used, and, provided it be retained in its place, it apparently may be depended upon. The blocks composing the platform were laid upon four courses of bricks. Several of the blocks of the casing were held together by stone cramps of the double wedge form.

According to Herodotus, Asychis, the successor of Myserinus, added lofty propylæa to the eastern front of the temple of Vulcan, and from a desire to surpass his predecessors, constructed a pyramid with bricks, upon which was this inscription—"Do not degrade me by comparing me with the pyramids built with stone, which I excel as much as Jupiter excels the other gods, for those who built me thrust poles into the lakes, and, collecting together the mud which adhered to them, they made bricks, and thus they constructed me." The pyramid in question has been supposed by Mr. Hamilton, and by other good authorities, to have been built by Asychis: and in support of that opinion it may be observed that it is the most considerable pyramid built with bricks, and that it is near the other pyramids built with stone, with which it might have been compared, and also that it is within a short distance of the Temple of Vulcan, which Asychis had so considerably embellished: the solidity of its construction is likewise remarkable, not a single brick appears to have settled from its place; and, although the boasting terms of the inscription has excited much surprise, it is difficult to imagine a mass more solid, and also more durable, as long as it was protected by an external casing of stone from the effects of the atmosphere. It is certainly, therefore, as superior to those built with common stone rubble, as Jupiter may have been supposed to the other gods. As the whole of the bricks are not composed of alluvial soil, the latter part of the inscription can only refer to those formed of the mud, or clay, drawn out of one of the sacred lakes. If it be urged that this pyramid could not have been built by Asychis, because from having been cased it must have had the appearance of stone, it may be remarked, that all the brick pyramids in Egypt (which are four) appear to have been covered with stone; and likewise that the above mentioned inscription would have been unnecessary had the material, of which the pyramid was formed, been apparent.

The southern brick pyramid is much destroyed, and Mr. Perring did not discover any traces of the chamber, the roof of which is stated by Dr. Richardson and others, to have fallen in, nor did he perceive any considerable settlement. It is built in the same manner, but not so carefully, as the other brick pyramids. The bricks contain a greater quantity of straw, and vary from $15\frac{3}{4}$ ins. to $13\frac{1}{2}$ ins. long, and $7\frac{1}{2}$ ins. to $6\frac{1}{2}$ ins. wide, and $5\frac{1}{2}$ ins. to $4\frac{1}{2}$ ins. thick. The upper surfaces have been marked with the fingers.

Civ. Eng. & Arch. Journ.

To be Continued.

Atmospheric Railway—Working Expenses compared with those of ordinary Railways using Locomotive Power. By J. HERAPATH.

We have here entered upon ground altogether unbroken and unknown to practical men. The damage that is done by locomotives to the roads, though evidently more than the carriages, is, to the best of my knowledge, unknown apart from the trains. We cannot tell whether the engine injures the road in proportion to its weight, or in a higher ratio. Neither can we say what would be the cost of keeping the atmospheric piston, main, &c., in repair, for we have had literally no experience of it. No doubt exists in my mind but that many little items of expense will occur, of which we have, at present, no conception. Among these will be keeping the joints of the main tight, which is generally a troublesome thing even in water and gas pipes, where no force, or jostling, whatever is experienced at all comparable with that upon the atmospheric railway. Keeping the main in gage, if I may so express myself, with the rails, will be another element of expense. The maintenance of the valve they may form some idea of from the experience they have had, though they want the trial of a hard winter, to test both its efficiency and the expense of its maintenance. Other items will, doubtless, make their appearance in due course, but at present they are altogether so out of the range of our knowledge, that I do not see how we are to estimate them. I, therefore, propose to set off such things, as we cannot estimate against the wear of the road by the locomotives, (except the wages of two men to attend to the main,) which will, in all probability, be much in favor of the atmospheric.

Another great difficulty we have in comparing the working expenses of the atmospheric plan with the locomotive, is the not being able to reduce the expenses to particular units, as, for example, to tons per mile; for the atmospheric advocates may say, "it is true ours cost so much more according to this mode of comparison, but we could do double business at little, or no, increase of expense, as we are always obliged to keep our fires up, our engines going, and our mains exhausted, to be ready for contingencies whether we have trains, or not, whereas you can lower your power nearly in proportion to the work you have to do." There is much truth in this, but it tells the other way too, as it shows the greater convenience, and superior adaptation of the locomotive system to circumstances.

Besides I apprehend we must not set up an imaginary business, nor argue from what might be done, but take things as they are, and deduce our expenses from what is to be done, not from what may under ideal circumstances be done. I propose, therefore, to take one or more lines with the trade existing on them, and institute a comparison between the working expenses of their locomotive power, and those of the atmospheric, if applied to do the same work on the same lines. But as in this there might be some disadvantage to the atmospheric by particular selections, owing to there not being sufficient business on the line, I shall choose two to which I think it is

impossible on that, or any other, score to make an objection, namely, the Great Western, and the London and Birmingham. Both of these lines are of a length, which would be a decisive test, possess each a trade of the first magnitude, and a laudable emulation in their managements to rival each other.

Divide their loads how they may, I think it will be allowed that a less powerful apparatus than that at Dalkey could not work either of these lines. Indeed, I should rather be inclined to doubt whether the Dalkey instruments would be sufficiently powerful for either of them. For the Great Western I firmly believe they would not. However, we will strain a point, and grant that they would.

On the Great Western the locomotive expenses for the year 1843, as per reports, have been,

	£	s.	d.
Half year ending June 30, ...	33,402	19	5
“ “ December 31, ...	33,393	14	0
Total for 1843, ...	66,796	13	5

which includes coke for stationary engines, rates, taxes, and gas, and every other expense connected with it. For four months of the year they worked 181 miles, and for the remaining eight 190. We may, therefore, reckon 187 miles as the average run for the year, which will give better than £357 per mile per annum. Now the Great Western is a line on which it has been alleged that 18 miles of it, that is the Cheltenham part, have been worked at a loss. Had the whole, therefore, been equally profitable the per mile locomotive power, as respects the traffic receipts, would have been less.

On the London and Birmingham Railway the cost of locomotive power for the main line, 112½ miles, deducting the Camdentown part, 1½ mile, worked by a stationary engine, and without noticing the Aylesbury line, was, for 1843, as per reports,

	£	s.	d.
Half year ending June 30, ...	31,189	13	11
“ “ December 31, ...	32,649	10	2
Total for 1843, ...	£63,839	4	1

or at the rate of something more than £575 per mile.

These two sums differ more than one might have expected, but their ratio is not far out of that of the receipts per mile of the two lines.

Let us now turn our attention to the working expenses of the atmospheric. It is impossible to do this with the accuracy we have the locomotive, because many items of expense in this have yet to be learned from experience, as, for example, the reparations and greasing of the valves generally, the inside coating of the mains, the repairs and renewal of the pistons, with their lifting and closing rollers, the keeping of the joints of the main tight, and the keeping of the main in gage with the rails, and every now and then supplying a new length of main, the consequence of accident, &c., &c. The warming pans we do not include, because we apprehend their proved useless-

ness will cause them to be dispensed with. Except the wages of two men to superintend and attend to the main and valve, I purpose, as I have said before, to set all this against the damage done to the road by the locomotive—a concession by which I am satisfied the atmospheric system will be a considerable gainer.

Our calculation gives a much higher value—nearly double—for horse-power of the engine than theirs, but we will take it at their own estimate, that is at 100 horse-power, and their own statement 5 lbs. per horse-power per hour for the coals consumed, and we shall then have 500 lbs. per hour for the consumption. Now if the atmospheric railway was to be applied to either of the two great lines previously mentioned, and to carry the mails, their fires had need to be kept up nearly the 24 hours round. At all events they must be kept going the 17 hours now worked by both of these lines. Then we shall have 8,500 lbs., or 3.80 tons, per day. Supposing this costs 10s. per ton, and I hardly think we could get it here for less, we have £1.90 per diem, or £693 10s. per annum, for the cost of fuel. Hence the following estimate:—

Estimate for 1½ mile per annum of Atmospheric.

Coals, ...	£693 10s.
Repairs of engine and machinery, including fire-bars, boilers, hemp, oil, &c., at £1 per h. p. per annum,*	100 00
	£793 10
One engineer, one stoker, and two men for looking after the 1½ mile main and valve at £6 10s. per week,†	£338 00
	£1,131 10
And per mile per annum, ...	£754 7
Add interest on £11,000 extra cost, at 5 per cent.,‡	550 0
Total per mile, ...	£1,304 7

Thus we have, in round numbers, £1,300 by the atmospheric, to do what is now done by locomotives on the Great Western for £357, and on the London and Birmingham for £575.

Lond. Railway Mag.

Utility of Wire Ropes.

The question of the comparative strength of hemp and wire ropes used in the “winning” of coal, and, indeed, for every other purpose for which rope is applicable, having been frequently discussed in our columns, we have pleasure in complying with the request of a correspondent, by inserting the following communication, addressed to Mr. Newall, manufacturer of wire rope, by so distinguished a colliery viewer as Mr. Matthew Liddell, dated from Benton Grange:—“Dear Sir, I consider the following information may be interesting, and cer-

* Wood’s Practical Treatise on Railroads, p. 755, 3rd ed.

† The London and Birmingham expense at Camdentown.

‡ In such property the interest ought to be at least 7 per cent.

tainly goes far to establish confidence in the equal security of flat wire ropes with those made from hemp, when exposed to a sudden violent strain; which, it has been stated, would cause the former to snap, or break. On Monday last, when employed in drawing coals, the breaksman of the engine, (45 horse power) on which a pair of your flat wire ropes were put in June last, neglected to check the engine on the approach of the cage and tubs to the surface; and, consequently, the engine continued at full speed, (the rope moving about 120 fathoms a minute,) until suddenly stopped by the cage coming into violent contact with the pulley. The shock slightly displaced the pulley frame, when the rivets of the shackle which you attach to the end of the rope where the cage is hung on to it, were drawn through the strands of the rope, and the cage and coals fell on the "keeps" at the top of the pit, which prevented their falling down the pit, so that the damage done was trifling. I have since then had the wire rope examined, and, although the strain on it must have been very great to stop the engine, yet it does not appear to have sustained any injury, and is, apparently, as good as when it was first put on.

MATTHEW LIDDELL."

London Mining Journal.

Description of a Machine for Raising and Lowering Miners. By JOHN TAYLOR, M. Inst. C. E.

The author states that the great depth to which the copper and tin mines, in Cornwall, and in Germany, had been worked, had drawn simultaneously, in the two countries, the attention of engineers to some mode of facilitating the ascent and descent of the miners, whose strength was exhausted, and their health seriously affected, by the fatigue of going to, and returning from, the scene of their labors, by nearly vertical ladders, as the men could not be raised and lowered by the rope of the winding engines, as in the coal districts. The Polytechnic Society of Cornwall offered premiums for machines for effecting this object, and in 1834, three prizes were respectively awarded to Mr. Michael Loam, Capt. W. Nicholas, and Capt. W. Richards, for plans, the two first of which embraced the principle which has since been adopted with modifications, both in Germany and in Cornwall. A premium was also offered by Mr. Tremayne, for any new method, or for the most available improvement on the former plans, and was awarded in 1838 to Mr. John Philips, for a method, differing, however, from that which has been put in practice. About this time it was ascertained that a machine, somewhat similar to that designed by Mr. Michael Loam, had been applied with success to one of the deepest mines in the Hartz; and drawings, with a description, were published in the report of the Polytechnic Society in 1838. Mr. Charles Fox also commenced a subscription, for the purpose of awarding a sum of money to any proprietor of mines who would first bring into active operation efficient machinery, adapted for the purpose in question.

At length, the adventurers of the Tresavean copper mines, undertook to erect a machine from the designs, and under the superintendence

dence of Mr. Michael Loam; it was first used for a depth of 27 fathoms, on the 5th of January, 1842, has since been extended to 264 fathoms, and it is now contemplated to carry it to the lowest part of the mines, which is 288 fathoms deep.

The machine, which is worked by a steam engine with a cylinder of 36 inches diameter, consists of two rods, to which are attached, at intervals of 6 feet throughout their length, platforms, upon which the men stand; these rods receive an alternating motion from two cranks, which give them a stroke of 12 feet; the men, either in ascending, or descending, step from one platform to the other, as the rods remain, for an instant, almost stationary, when the cranks are going over the top and bottom centres; and, as the platforms are half the length of the stroke apart, one set of men can ascend while another set is descending, without at all interfering with each other. Each rod makes three strokes per minute; and when once the platforms are filled with men, they are landed at the rate of six men per minute, either going up, or down; the speed of traveling being about 72 feet per minute, or 240 fathoms in 20 minutes. By the ordinary mode of ascending by ladders, it would have occupied 48 minutes to mount from the same depth, as the usual speed is about 30 feet per minute, so that more than 50 per cent. of time is saved, independent of the diminution of fatigue.

The rods at the Tresavean mine act vertically for the first seventy fathoms, below which they follow the direction of the vein, diverging from the perpendicular from six inches to eighteen inches in six feet. The action of the apparatus is stated to be perfectly successful; no accident has occurred in the use of it, and the miners are convinced of the safety, as well as the ease, afforded by it.

Lond. Journ. Arts & Sciences.

Blasting by Electricity.

A very interesting display of engineering skill took place at Knockmaroon hill, in the Phoenix Park, Dublin. A huge mound of earth covering a quarry, had been perforated with nine chambers, in which two tons' weight of gunpowder had been so distributed, as, by the application of the galvanic battery, to be exploded at once. The operation was conducted under the superintendence of Capt. Larcom, of the Royal Engineers, and, at a little after three o'clock, every thing being in preparation, and all due precaution being taken to prevent accidents, the explosion took place without any very alarming noise, the vast mound of earth rising, wave like, about three, or four, feet, and then rolling over in a dense mass into the hollow underneath. The object of the experiment, which was completely successful, was for the purpose of cutting away a high precipice, so as to form an inclined level with the road, or pathway, below it. About twenty feet of the park wall close to the embankment, gave way from the effects of the concussion, but no other casualty occurred.

Mechanics' Mag.

Proceedings of the Institute of Civil Engineers.—From the London Athenæum.

Slips in Cuttings and Embankments of Railways—April 2.—Some observations were made by Sir H. T. De la Beche, the Rev. Mr. Clutterbuck, and several members, on the geological features of the slips, whether occurring naturally in cliffs, as at the back of the Isle of Wight, or in the artificial cuttings of railways. It was contended, that, in both cases, the reduction of the lower and softer beds to the state of mud, by percolated water, rendered them incapable of bearing the weight of the superincumbent strata, and that the mass, when saturated, slid down by its own gravity; but that slips in railway work were accelerated by the vibration caused by the passage of the trains. The vibration of the air from the discharge of a gun, had been known to cause an avalanche; and the cases were almost analogous. More attention, both to surface and bottom drainage of the slopes, was much insisted upon; and it was urged, that the back drains, so close to the top of the cuttings, were prejudicial; that in the dry season the bottoms cracked, the rain found its way through, and it had been frequently noticed that the slips commenced at a few feet below the level of these drains. The dry shafts which had been sunk in the slopes of the Eastern Counties Railway, by Mr. Braithwaite, with the concurrence of Sir H. T. De la Beche, were instanced as successful in rendering wet and treacherous strata comparatively dry and secure. A section was exhibited of the embankment at Hanwell, on the Great Western Railway; this embankment, which was of gravel, was fifty-four feet high; it was laid in a marshy valley traversed by the river Brent; the London clay, upon which it was laid, inclined towards the river, and at one of the numerous fissures with which that stratum abounds, a subsidence occurred squeezing up, at the same time, on the lower side, to as great an extent as the embankment sunk, which was stated to be nearly as much in one year as the entire mass of the embankment. This subsidence was stopped by loading the foot of the slope, and thus restoring equilibrium, and it was stated to be at present quite secure. It was urged that, in the earthwork of canals, where there was no vibration, the slips generally occurred in the first few months after the formation of the embankments; but that, on railways, they occurred quite as frequently after the lapse of several years. It appeared, therefore, that much was due to vibration.

Account of the Railway from Amsterdam to Rotterdam.—April 16.—This railway, which is the first that has been constructed in Holland, was commenced under adverse circumstances, and the works languished until the appointment of the author (Chevalier F. W. Conrad,) as the engineer director, when it appears, that although, from the defective state of the law of expropriation, great difficulty was experienced in obtaining possession of the land for the railway, the works were carried forward so vigorously, that the four divisions of the railway, extending from Amsterdam to the Hague, were com-

pleted between March 1839, and December, 1843, leaving only the fifth division between the Hague and Rotterdam, to finish the line, and of that the works were proceeding rapidly. The length of the line; when the whole is finished, will be about $52\frac{1}{2}$ English miles, and the cost of the single line of rails laid is about £1475 per mile. The detail was given of all the conditions of the contracts, the prices and quantities of materials, the method of execution, the forms and dimensions of the buildings, of the bridges, some of which are of cast-iron, large sized, and very ingeniously contrived for opening, for the facility of the navigation; *the iron beams of one of these bridges were seventy-three feet long, cast in one piece.* Other bridges of timber, on the American trellis-work principle, and of very large span, were also described. The mode of construction of the permanent earth work was then described: almost the whole line, being through marshy ground, was laid upon fascines, and in some places it was carried entirely by these means through water of considerable depth. An ingenious mode of cutting off the heads of the piles under water was then described, and it was thought that its simplicity would induce its introduction into the English engineering works. All the other particulars of the railway works were given in the most minute detail, with tabular statements of the number of passengers conveyed, the receipts, the number of miles traversed by the locomotive engines; and the paper was illustrated by a large collection of maps, sections of the line, and drawings of the construction of all the bridges and other works of the line.

ENGLISH PATENTS.

Specification of a Patent granted to CHARLES KÜBER, of Leeds, in the county of York, for improvements in Fixing Color in Cloth.
—Sealed 7th March, 1840.

This invention consists, firstly, in the use of bichromate of potash, as a medium for uniting the coloring ingredients, used in dyeing, with the wool, whereby a faster, brighter, and cheaper color is obtained, and is more effectually fixed in the cloth than by using the mordants generally employed, such as sulphate of iron, and sulphate of alumina and potash, or, as they are commonly called, copperas and alum.

In consequence of the great affinity of bichromate of potash to the wool, as well as to the coloring ingredients, a comparatively small quantity of it will fix the dye-wares; that is to say, one pound of bichromate of potash can be used instead of from three to four pounds of alum, or copperas; besides which, the color produced by the use of bichromate of potash is fast in alkalis and air, and better resists the operations of scouring, and the milling process employed in the manufacturing of cloth; and less coloring ingredients are required to be used than by the ordinary mode, because the color, produced thereby, being faster, no loss of color will take place when scouring the cloth

with soap; and the fibres of the wool, in the dyeing of which bichromate of potash is employed, will not be injured, as they have hitherto been, by the acids contained in alum, or copperas; and, on the contrary, the cloth will be softer, and easier to be scribbled and milled; and, consequently, the same quantity of wool will produce a greater and better quantity and quality of cloth than by the method usually employed.

The ordinary coloring ingredients are employed in conjunction with the bichromate of potash; and as every different shade and color requires a different proportion of ingredients, and the dye-wares differ so much in quality, that sometimes a double quantity of them is required, it is impossible to state the different proportions in which the bichromate should be used with them, the requisite amount varying according to the quantity of ingredients to be fixed in the wool; but the patentee generally employs three pounds of bichromate of potash for preparing one hundred pounds of scoured wool; and he sometimes adds two pounds of argal, or tartar. In the liquor, thus produced, the wool is boiled for one hour and a half; and on the next day the color is filled up with as much of the coloring ingredients as the desired shade may require.

The second improvement consists in obtaining green colors perfectly fast in acids, alkalis, and air, by dyeing the wool blue, and then manufacturing the cloth from the blue wool, so as to make it what is called partly finished cloth, with a white, or colored, list, and then adding the yellow wares, or ingredients, to the cloth, instead of to the wool; by which means a perfectly fast green color will be obtained, similar in appearance to wool-dyed green, but much faster. Every kind of yellow ware may be used, but fustic is preferred; and in order to fasten the color, hydrochloric acid, saturated with tin, is used, to which is added as much water as will give the solution a specific gravity of 1.2612, or 30° Baumé; and of this solution from six to seven pounds is used for every one hundred pounds of cloth, besides the usual quantity of alum and argal. This solution could not be applied to wool in fleeces, as it would be destructive to the use of soap, and, consequently, to the milling process.

The last part of this invention consists in the use of soda and bran for dissolving the indigo in the vats for dyeing blue, whereby the indigo is better fixed in the wool, and at a less expense than is incurred by the use of woad, madder, and bran, which are usually employed for that purpose.

The soda is employed in the following manner:—In a seven feet vat the water is heated to 125° Fahrenheit, and sixty-five pounds of bran, thirty-five pounds of common soda, (which has about 23 per cent. of carbonate of soda,) and four pounds of indigo, are thrown into it, together with the same quantity of lime as is usual for woad vats. The vat is worked from 110° to 118° Fahr., three, or four, times during the day without stirring; and in the evening the vat is heated to a temperature of 125°, and into it is thrown about four pounds of lime, six pounds of bran, and five pounds of soda, with such an additional quantity of indigo as may be required for the following day;

after this addition the vat is stirred as usual. If the vat has been working during the day, the above quantity of lime, bran, and soda, is added every evening, together with the requisite quantity of indigo. It would be difficult to state the exact quantity of indigo required, as any amount, from half a pound to twenty-five pounds, may be added, according to the shade of color required to be produced the following day. After proceeding in this manner for eight, or ten, weeks, the sediment is removed, and, with the liquor in the old vat, the operator sets a new vat, adding thirteen pounds of bran, and ten pounds of soda, with as much lime and indigo as may be required. The use of lime being to check the fermentation produced by the bran, it is impossible to state the exact quantity which may be required; but enough is used to check the fermentation in the vat to such a degree as will be sufficient to deprive the indigo of its oxygen, without an immoderate fermentation, which is very prejudicial. The vat, in which the soda is used, must be perfectly yellow; that is to say, the indigo must be perfectly deprived of its oxygen, or, as it is generally termed, the indigo must be "sprung," in which case the vat appears yellow. By the use of soda ashes, (which have about 46 per cent. of carbonate of soda,) instead of common soda, half the quantity will produce the same effect. Pearlash may likewise be employed, if the price will admit of it; and fine sharps may be used instead of bran.

The claims made by the patentee are, first, the use of bichromate of potash as a substitute for copperas, alum, and other mordants; secondly, the production of perfectly fast green colors, by dyeing the wool blue, and adding the yellow ingredients after it has been manufactured into cloth; thirdly, the use and application to indigo of soda and bran, or soda ashes and bran, either by themselves, or mixed with woad and madder, whereby the color is fixed in the wool better and cheaper than by the use of woad and madder alone.—[Enrolled in the Enrolment Office, September, 1840.]

Lond. Journ. Arts & Sciences.

Specification of a Patent granted to JOSEPH DANIEL DAVIDGE, for Improvements in manufacturing certain materials as substitutes for Whalebone, applicable to various useful purposes, and in the machinery for effecting the same.—Sealed 24th July, 1843.

These improvements consist in the application of strips of metal, either rolled, drawn, or twisted, into tubular forms, for various purposes to which whalebone is now applied; and also in suitable machinery for forming the same into tubes.

The advantages to be derived from the application of twisted strips of metal, or metal tubes, over the use of whalebone, are elasticity, durability, lightness, and economy; and the principal objects to which they may be applied, are riding and other elastic whips; whip-stems, as intermediate pieces between the thong and the handle; umbrellas and parasols, as the framing over which the cotton, silk, or other fabric, is distended; stems for feathers, walking-sticks, fishing-rods,

and ramrods; the flexible stems of brushes, or apparatus, for sweeping flues, or chimneys; as substitutes for the pieces of whalebone, or cane, employed for stiffening the caps worn by boys and men, and a variety of other useful purposes.

Various modes of forming the tubes, either by twisting, rolling, or drawing, the strips of metal, and a variety of mechanical contrivances for effecting these objects, may be suggested; but the method preferred by the patentee, is forming the tubes of strips of metal, by twisting the said strips helically, or conically, round a mandril, in the following manner:—Sheet metal for forming the tube is cut into strips of the desired breadth, according to the stiffness intended to be given to the tube, and these strips are then twisted round a mandril. They are afterwards drawn several times through “draw-plates,” in order to bring them to the required diameter; they may be passed through one, two, or more, pairs of grooved rollers, and by altering the shape of the grooves therein, the tubes can be made to assume a circular, oval, square, or any other desired form. When this operation of drawing, or rolling, has been effected, the helical twists are in a compressed state, and only show a space between them, when the tube is bent out of a straight line. The tube is then hardened and tempered, great care being taken to keep it straight, and, if required, it may be turned and polished in a lathe, or ornamented in any other manner. It should be remarked, that the length of the strip of metal must be according to the length of the tube required, as no joining of the strip of metal can be effected, either during the operation of making the coil, or afterwards; and the circumference of the mandril must not be less than the breadth of the strip of metal intended to be used.

The patentee claims, as his invention, “drawing, rolling, or twisting, strips of metal, by any convenient means, into the forms of tubes, or rods, to be applied to the purposes above mentioned.”—[Enrolled in the Petty Bag Office, January, 1844.]

Ibid.

MECHANICS, PHYSICS, AND CHEMISTRY.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

ON BELTS: from *Morin's "Aide Mémoire de Mécanique Pratique."*
Translated by ELLWOOD MORRIS, C. E.

For transmitting the motion of one revolving axis to another at a distance, we frequently employ belts of black dressed leather, passing over pulleys, or drums.

* It is well known to machinists and engineers that at the present day in many of our cotton, and other mills—especially where fast speeds are required—all the principal motions are communicated through belts.

Some of the heaviest cotton mills in this country are now (and for many years have been,) driven entirely by belts of a foot, or more, in breadth, impelled at high velocities, by large

Theory and practice show,

1. That when these belts are properly bent they do not slip, and they transmit velocity, in a constant ratio, inverse to that of the diameters of the drums.

2. That in transmitting motion from one axis to another by endless cords, or belts, the sum of the tensions of the two parts remains constant, so that when the tight, or conducting, side stretches, the slack, or conducted, side relaxes the same quantity, and that the sum of the tensions of the two sides is the same as when the machine is not in motion.

3. That the resistance of belts to slipping is independent of their breadth, and that there is no advantage in augmenting this dimension beyond what is necessary to enable the belt to resist the strain which it is to transmit.

4. That the effort S , necessary to make a belt slip upon a drum, of which the tension is t , or a cord on the throat of a pulley, is given by the formula

$$\text{Log. } S = \log. t + 0.434 f \frac{S}{R},$$

an expression in which the logarithms are those of the tables, and where we represent by f . . . the ratio of friction to pressure for belts and drums, and of which the value should be taken from experiment equal to 0.47; for belts in their ordinary state of unctousness on drums of wood; 0.50 for new belts on drums of wood; 0.28 for belts in their ordinary state of unctousness, on cast-iron pulleys; 0.38 for wet belts on pulleys of cast-iron; 0.50 for cords of hemp on drums, or pulleys, of wood; S . . . the arc of the circumference embraced on the drum, or pulley; R . . . the radius of the drum, or pulley.

The preceding formula becomes the following rule:

For calculating the tension which the tight, or conducting, side of a cord, or belt, wrapped upon a drum, should have to make the slack side slip under a given tension. Multiply the ratio of the arc embraced to the radius of the drum by 0.434 times the ratio of the friction to the pressure; add the product to the logarithm of the given tension of the slack, or conducted, side. The sum will be the logarithm of the tension sought.

Note.—This rule shows that it is useless to augment excessively the diameter of drums, with the view of preventing belts from slipping.

drums geared to the water-wheels, and made to move so fast at their peripheries as to give to the belts a speed of 1500, or 2000 feet, in a minute.

A broad belt, moving at a high velocity, is capable of transmitting a prodigious power with greater economy and convenience, in many cases, than gearing.

With proper tighteners they have been very successfully applied to saw mills—indeed, even at a low velocity, belts have been made to drive fulling stocks, one of the most desultory motions in mechanics—in fact, their great utility is so well known to all who are conversant with machinery, as to need no comment. They have, however, been generally employed very much at random, and without previous calculations.

The above essay of M. Morin supplies a desideratum long wanted here, and the writer having derived much advantage from it, in computing the powers and widths of belts, has translated it, with the hope that it may prove valuable to the mechanical readers of this journal.

E. M.

Example.—What ought to be the tension of the tight side of a leather belt which embraces the semi-circumference of a wooden drum of 0.35 metres radius, in order to make the slack side slip under a tension of 50 kilogrammes?

The formula gives

$$\text{Log. } S = \text{log. } 50 + 0.434 \times 0.67 \times 3.14 = 2.33947;$$

and, consequently,

$$S = 218.5 \text{ kilogrammes.}$$

Rule and Table Practical.—The preceding rule requiring the use of a table of logarithms, we have calculated the following table, which gives the value of the strain, S , capable of slipping a cord, or belt, on a pulley, or drum, when we know the tension, t , of the slack side, or the resistance to be overcome, and the ratio of the arc of the circumference embraced by this cord, or belt, to the entire circumference, commonly given by the drawings. In calling K , the ratio of the tension S , to the resistance t , we have $S = Kt$, and we have thus found the values of K , in the table.

Ratio of the arc embraced, to the entire circumference.	Value of the Ratio K.					
	New belts on drums of wood.	Belts in their usual state.		Wet belts on cast iron pulleys.	Cords on drums, or rollers, of wood.	
		On drums of wood.	On pulleys of cast iron.		Rough.	Polished.
0.20	1.87	1.80	1.42	1.61	1.87	1.51
0.30	2.57	2.43	1.69	2.05	2.57	1.86
0.40	3.51	3.26	2.02	2.60	3.51	2.29
0.50	4.81	4.38	2.41	3.30	4.81	2.82
0.60	6.59	5.88	2.87	4.19	6.58	3.47
0.70	9.00	7.90	3.43	5.32	9.01	4.27
0.80	12.34	10.62	4.09	6.75	12.34	5.25
0.90	16.90	14.27	4.87	8.57	16.90	6.46
1.00	23.14	19.16	5.81	10.39	23.90	7.95
1.50					111.31	22.42
2.00					535.47	63.23
2.50					2575.80	178.52

Use of this Table.—By the aid of these values it is easy to calculate the tension, capable of slipping a cord, or belt, in surmounting a given resistance, or the effort necessary to sustain and cause to descend slowly a given weight.

First Example.—What ought to be the tension of the tight side of a common belt to make the slack side slip on a wooden drum when its tension is 50 kilogrammes, the arc embraced on the surface of the drum being a semi-circle?

The table indicates for these data that the multiplier $K = 4.38$, we have then

$$S = 4.38 \times 50 \text{ kilog.} = 219 \text{ kilog.}$$

The formula previously enunciated, gives, for the same case,

$$S = 218.50 \text{ kilogrammes.}$$

Second Example.—What is the effort exerted by a cooper to sustain a pipe of wine, which, in slipping upon an inclined plane, exerts on each of the sides of the cord retaining it, a tension of 250 kilogrammes, supposing that he has made two turns of each side about a roller with a polished surface, but stopped by a catch?

The value of the multiplier is here $K = 63.23$. We have then for each side,

$$t = \frac{S}{K} = \frac{250 \text{ kilog.}}{63.23} = 3.95 \text{ kilog.}$$

or, for both sides, $= 7.90$ kilogrammes.

Observation.—We see by this last example what facility the friction of cords gives for moderating the descent of loads; but in these manœuvres it is necessary to take great care in avoiding shocks, and to operate uniformly.

Rules for establishing a transmission of Motion by Cords, or Belts.—For establishing the transmission of motion by endless cords, or belts, it is necessary, first, to determine the power which is to be transmitted to the pulley, or the drum. In dividing this by the velocity of the belt, or that which the surface of the drum is to take, we shall have the strain, Q ,* which is to be transmitted by the belts, or an approximate value of the difference of the tensions of the tight and slack sides S and t ; we shall have then,

$$S - t = Q.$$

We will calculate then the least value that we may give to the tension t , of the slack side, by means of the relation,

$$t = \frac{Q}{(K-1)},$$

which becomes the following rule in words:—

Rule.—Search in the table, above given, for the value of the ratio K , of the tension of the two sides, at the moment when they begin to slip, according to the state and nature of the belts and drums; from this number K , deduct unity, and by the remainder divide the strain Q , to be exerted at the circumference of the drum, to overcome the resistance.

The quotient will be the least tension that we can give to the slack side.

In this calculation, we take for Q , the greatest value that it can attain, including friction, and other forces besides the tensions S and t ; and to make sure that in the accidental variations of resistance, or tension, the belt shall not slip, as well as to compensate, approximately, for the influence of the tensions on the friction of the axis, we augment by *one-tenth*, at the least, the value given for t , by the preceding rule.

Knowing t , we shall have the greatest of the two tensions,

$$S = Q + t;$$

* Thus knowing the number of horses power to be transmitted—then 33,000 lbs. at one foot per second, or 76½ kilogrammes, moving one metre per second, $\times$ the horse power will $= P$; and $\frac{P}{v} = Q$, where v = the velocity of the belt.—*Trans.*

and, consequently, the sum of the two tensions $S+t$, of which the half will be the tension of each of the two sides when not in motion.

Example.—What ought to be the tension of the slack side of a leather belt wrapped on the semi-circumference of a cast-iron pulley 0.30 metres in diameter, the resistance to overcome at the circumference of this pulley being 35 kilogrammes?

The arc embraced by the belt, in its ordinary state, upon the cast-iron pulley, being 0.50 of the circumference, we find in the table $K=2.41$, and, consequently, the above rule gives

$$t = \frac{35 \text{ kilog.}}{2.41 - 1} = 24.83 \text{ kilog.}$$

Adding a tenth, we carry this tension up to 27.31 kilogrammes, and the tension of the tight side will be

$$S = 35.0 + 27.31 = 62.31 \text{ kilog.}$$

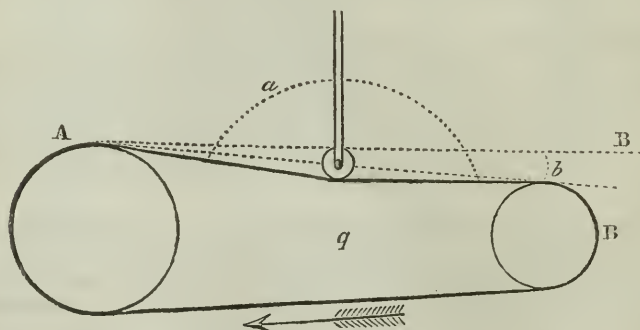
The tension natural to a state of rest, for each of the sides, will be

$$S = \frac{S+t}{2} = \frac{62.31 + 27.31}{2} = 44.81 \text{ kilog.}$$

Of Tighteners.—In order that the natural tension of the belts may remain constant, that it may attain and not surpass the value that we have calculated, it is necessary to employ *tighteners*. We will calculate the weight, q , of these tighteners by the approximate formula,

$$q = \frac{Q S, \cos. a}{\cos. b},$$

in which a = half of the angle formed by the two parts of the belt on which it rests, or presses, which angle we can fix at will; b = the angle made by the line $A B$, with the horizontal.



This formula becomes the following rule:—

For calculating in the case, shown by the figure, the weight of a tightener capable of producing, by its pressure on the two sides of a belt, a given natural tension: multiply the given natural tension by twice the cosine of half the angle formed by the two parts of the belt, (at the tightener) and divide the product by the cosine of the angle made by the common tangent ($A B$) of the two drums with the horizontal line $A B$.

In this case we ought to give to the belt a length, such, that at rest it will take the flexure fixed, and the tension S , will then have very nearly the value which has been assigned to it. We reserve, moreover, by known means, the faculty of augmenting, or diminishing, at will the action of the weight of the tightener.

Note.—If, for certain dispositions of drums, the tightener cannot act vertically, we may, by a proper combination of levers, produce its action in such direction as shall be necessary, and then we calculate the effort which it ought to exert on the belt, perpendicularly to the line $A B$, by the above rule, supposing then the angle b , to be null, and its cosine equal to unity.

Example.—In the example preceding, the angle a , being 85° , and the inclination of the line $A B$, 10° , what ought to be the weight of the tightener?

The formula gives,

$$q = 89.62 \times \frac{0.0872}{0.9848} = 7.93 \text{ kilog.}$$

In conclusion, relative to belts, we will add, that we may, without any risk, and with the certainty that they will run a long time, make them support tensions of 0.25 kilogrammes per millimetre square* of section, which allows us to calculate their breadth when we know the thickness of the leather employed.

Finally, the pulleys over which leather belts pass ought to have a convexity equal to about one-tenth of their breadth.

NOTE BY THE TRANSLATOR.

As an example, let us suppose—that a paper mill *rag-engine*, with a 24 inch roll, running 150 revolutions, requires $5\frac{1}{2}$ horses power to drive it alone—that the motion is to be transmitted to it from a lying shaft running 70 revolutions, by means of a leather belt one-seventh of an inch thick, moved by a cast-iron polished pulley, four feet in diameter, the belt embracing half of its circumference.

Query.—The width proper for the belt. $355 \text{ lbs.} \times \frac{1}{7} = 50 \text{ lbs.}$ per inch wide, the strain which a belt of one-seventh of an inch thick, would safely bear.

Power. = $33,000 \times 5\frac{1}{2} \text{ h. p.} = 176,000 \text{ lbs. 1 ft. per minute} = P.$

Velocity. = $4 \times 3.14 \times 70 \text{ revo.} = 875 \text{ ft. per minute} = V.$

$$K = 2.41 \frac{P}{V} = \frac{176,000}{875} = 200 \text{ lbs.} = \text{diff. of tensions} = Q.$$

$$t = \frac{Q}{K-1} = \frac{200}{1.41} = 142 \text{ lbs., and } S = Q + t = 200 + 142 = 342 \text{ lbs.}$$

Finally, $\frac{342}{50} = \text{nearly seven inches, the width of belt required;}$ and 242 lbs. will be the tension of each side when the machine is at rest, supposing no tightener to be used in this case.

* = 355 lbs. per square inch of section, or for an eight inch belt one-eighth of an inch thick = 355 lbs. A millim. square = .00155 square inches.—*Trans.*

This example suffices to show how readily, by means of M. Morin's valuable formulæ, we may determine the widths of our belts by a direct process of calculation, and with a certainty of successful results where mere judgment would often fail.

E. M.

TO THE PUBLISHING COMMITTEE OF THE JOURNAL OF THE FRANKLIN INSTITUTE:—

Dear Sirs,—I observe, that in noticing an apparatus for ascertaining the specific gravities of liquids by the comparative altitudes of columns of water, and the liquid to be assayed, when reciprocally balancing each other, you refer to an apparatus upon the same principle received from Paris, by the Department of the Arts of our University nearly ten years ago.

I have sent to the Hall of the Institute an instrument, of which an engraving and description, under the name of *Litrameter*, will be found in the first volume, first series of your Journal (1826.) The same contrivance, in another form, was first made by me in 1807, or earlier; of that apparatus I have still the scale, and some other parts, in my laboratory.

The contrivance was original with me: I have never seen any similar instrument. As originally described in your Journal, a gum-elastic bag was employed to exhaust the tubes, while, by means of a cock and sliding rod, the columns were adjusted. Subsequently, I substituted a small syringe for both bag and rod. The litrameter has two scales, one for liquids heavier, the other for those lighter, than water.

Yours very truly,

ROBERT HARE.

On the Litrameter.

This name is derived from the Greek *litra*, weight, and *meter*, measure, and is given to one of the instruments which I have contrived for ascertaining specific gravities. The litrameter owes its efficiency to the principle, that when columns of different liquids are elevated by the same pressure, their heights must be inversely as their gravities.

Two glass tubes, of the size and bore usually employed in barometers, are made to communicate internally with each other, and with a gum elastic bag, G, by means of a brass tube and two sockets of the same metal, into which they are severally inserted. The brass tube terminates in a cock, to which the neck of the bag is tied. Between the cock and the glass tubes, there is a tube at right angles to, and opening into, that which connects them. At the lower end of this tube a small copper rod, R, enters through a collar of leathers.

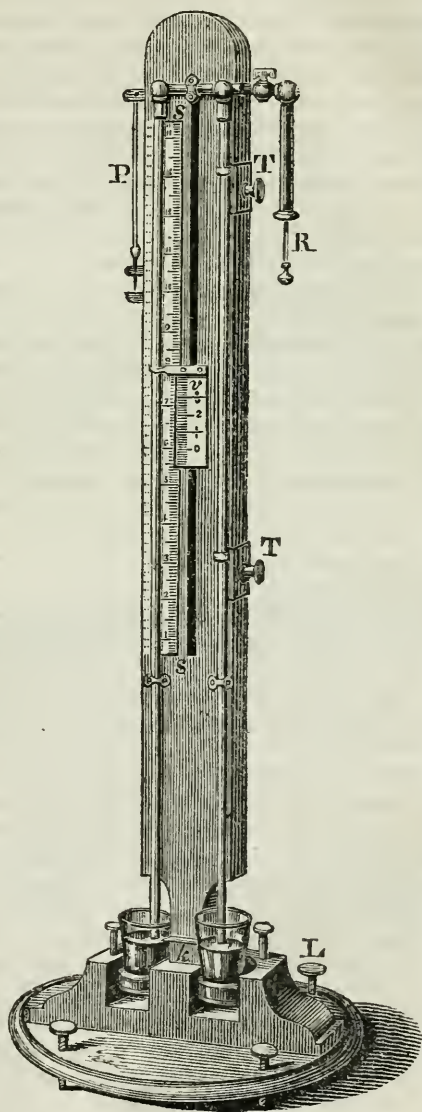
The tubes are placed vertically, in grooves, against an upright strip of wood, tenanted into a pedestal of the same material. Parallel to one of the grooves, in which the tubes are situated, a strip of brass is fastened, and graduated so that each degree may be about equal to $\frac{1}{220}$ of the whole height of the tubes. The brass plate is long enough

to admit of about 140 degrees. Close to this scale, a vernier, *v*, is made to slide, so that the divisions of the scale are susceptible of subdivision into tenths, and the whole height of the tubes into about 2200 parts, or degrees.

On the left of the tube there is another strip of brass, with another set of numbers, so situated as to comprise two degrees of the scale, above mentioned, in one. Agreeably to this enumeration, the height of the tubes is, by the aid of a corresponding graduation on the vernier, divided into 1100 parts, or degrees.

A small strip of sheet tin, *k*, is let into a kerf in the wood, supporting the tubes, in order to indicate the commencement of the scale, and the depth to which the orifices of the tubes must extend. At distances from this, of 1000 parts and 2000 parts, (commensurate with those of the scale,) there are two other indices, *T T*, to the right hand tube. Let a small vessel, containing water, be made to receive the lower end of the tube, by the side of which the scale is situated, and a similar vessel of any other fluid, whose gravity is sought, be made to receive the lower end of the other tube, so that the end of the one tube may be covered by the liquid in question, and the end of the other tube, by the water.

The bag being compressed, a great part of the contained air is expelled through the tubes, and rises through the liquids in the tumblers. When the bag is allowed to resume its shape, the consequent rarefaction allows the liquids to rise into the tubes, in obedience to the greater pressure of the atmosphere without. If the liquid to be assayed be heavier than water, as, for instance, let it be concentrated sulphuric acid, it should be raised a



little above the first index, at the distance of 1000 degrees from the common level of the orifices of the tubes. The vessels holding the liquids being then removed, so that the result may be uninfluenced by any inequality in the height of the liquids, the column of acid must be lowered, until its upper surface coincide exactly with the index of one thousand. Opposite the upper surface of the column of water the two first numbers of specific gravity of the acid will then be found; and, by duly adjusting and inspecting the vernier, the third figure will be ascertained. The liquids should be at the temperature of sixty.

If the liquid under examination be lighter than water, as in the case of pure alcohol, it must be raised to the upper index. The column of water, measured by the scale of 1000, will then be found at 800 nearly; which shows that 1000 parts of alcohol are, in weight, equivalent to 800 parts of water—or, in other words, 800 is ascertained to be the specific gravity of the alcohol.

The sliding rod and tube at R, between the cock and the glass tubes, facilitates the adjustment to the index, of the column of liquid in the right hand glass tube. When the rod is pushed in as far as possible, it causes a small leak, by which the air enters, and the columns of the liquids, previously raised too high, by the bag, may be allowed to fall till the liquid, which is to be assayed, is near the index. Then, by pushing the rod in, they may be gradually lowered, and adjusted to the proper height with great accuracy.

A rod of this kind, graduated, might answer the purpose of a vernier.

The bag of caoutchouc may be advantageously furnished with two valves, one opening from the tubes into the bag, the other from the bag into the air.

But, upon the whole, I find a syringe preferable; the adjusting rod being included in the rod of the piston, which is perforated for its reception, and furnished with a stuffing box, to render it air tight.

The plummet P, and the screws at L, enable the operator to detect and rectify any deviation in the instrument from perpendicularity.

We cheerfully insert the above, and apologize to the Doctor for our inadvertence in overlooking his *litrameter*, which was certainly familiarly known to us; in fact, attaching no particular importance to the matter, we referred to the piece of apparatus, by Leyeboours, as being the one which first came to mind, our object being merely to show that the thing had been long and well known. The exposition of Dr. Hare strengthens this our position.

Since, however, the subject has attracted some attention, (for we see by the English journals that Sir James Murray also sets up a claim to the invention,) we insert the annexed extract from the *Physique Experimentale* of Von Mussenbroek, published at Paris in 1769, which is as far back towards “the ancient Egyptians” as we have traced the apparatus:—

COM. PUB.

Extract from Physique Experimentale par M. Von Mussenbroek, traduit par M. Sigaud de la Fond, Paris; Bauche, 1769: 4to. 3 vols.; tom. ii, p. 233, § 1395.

“Others have used for this purpose (the determination of the specific

gravity of different liquids,) a recurved tube of glass, ACDEB, Plate II, fig. 2, (Plate xxxii, fig. 2,) to the upper part of which is adapted a transverse tube, DK, the mouth of which, K, is adapted to the air-pump. Then, having plunged the two extremities, A and B, of the bent tube, into the vessels which contained the different liquids, they worked the piston of the pump, and thus partially exhausted the air contained in the branches; the external air then becoming preponderant, raised the liquids in the two branches; that contained in the vessel A, being raised to the height AC, and that of the vessel B to BE. They reasoned thus, as the pressure of the atmosphere is felt equally upon the liquid contained in the vessel A, and upon that in B, the two columns of liquids raised in the two branches weigh equally, and, consequently, the relative gravity of the liquid in A, is to that in B, as the height BE, is to the height AC. This way of determining the specific gravity of liquids is very ingeniously imagined, but is not more accurate than the preceding, for the difference of the attractions of the tubes for the different liquids which rise in them, (whence follow necessarily different degrees of concavity, or convexity, of the surfaces of the liquids,) is an obstacle which prevents us from judging accurately of the two heights of the liquids. For this reason this method has been rejected. Fig. 3, Plate II, (fig. 14, of plate xxix,) represents a machine which has been used for determining the specific gravity of force of different liquids; but this method is exposed to the same inconveniences."

Extracts from the Report of Capt. G. W. HUGHES, of the Topographical Engineers, to the Secretary of War, relative to the working of Copper Ore.

In the immediate neighborhood of Carglaze are the Cressoda porcelain clay works. Water is here also essential as a mechanical and purifying agent. It is brought to run over banks of disintegrated granite into a pool, artificially excavated, from which the coarser materials, such as quartz and mica, are removed in cars drawn up inclined planes by horse power, leaving in the pool a creamy looking substance, which is the crude, or impure, kaolin. This is pumped up, and conveyed to a reservoir where the heavy and insoluble matter, (called *mica* by the workmen, which is probably the predominating material, as the coarser and heavier quartzose particles have been already separated,) is deposited by subsidence. After an interval of some hours, the upper, or fluid, stratum is drawn off into lower vats, when it is left to slowly deposit the porcelain clay; and when the water has become nearly colorless it is drawn off, and the clay, left in a semi-fluid state, (of the consistency of Devonshire cream,) is pumped into a reservoir, where it is left to consolidate, and partially to dry, after having been separated by a kind of spade into cubes of about 6 inches; from whence it is removed, when sufficiently coherent, to platforms, where it is thoroughly dried in the sun. The wet season (1841) had been very injurious to these works, and the cubes were

much abraded by the rains. To protect them from the moisture, they are covered with straw, which adheres to the clay; the blocks must, therefore, be carefully scraped before they are fit for market.

Kaolin is very abundant in the vicinity of St. Austell, and in Dartmoor, Devonshire, and may be traced, in all cases, to a common origin, viz., to the natural decomposition of a talcose granite, similar to the French *protegene*. It makes a very good porcelain, (manufactured in Wales, and in Gloucestershire,) but, of course, very inferior to the celebrated *Sèvres*,* and even to the *Dresden*, china.

The coarser kinds of kaolin were employed by the Romans, in Britain, for various economical purposes, especially for reservoirs and water pipes, some of which have been recently discovered in a perfect state of preservation. It was suggested by the learned Professor, in the course of his remarks, that this material might be substituted for lead and iron gas, and water, pipes, at a comparative trifling cost. I can certainly see no reason why it may not be used to much advantage for the sub-drainage of lands, and for water pipes, where they are not likely to be subjected to any very great hydrostatical pressure.†

The great mineral district of the west of England, is that composed of the parishes of Gwennap, Redruth, and Cambourne; and, looking to extent of workings, amount and constancy of produce, regularity of system, and beauty of arrangements, the "Consolidated mines," or "Consols," as they are commonly called, may be regarded as the most important copper mines of that district, and perhaps of the world.‡

The Consolidated mines consist of several detached mines which were formerly worked, but not successfully, by independent companies of adventurers. Previous to the year 1818, they had all been abandoned, and became filled with water. In 1819, operations were resumed, by the union of six different mines; and the "Consols," as the union was called, consisted of Cusvea, Wheal Fortune, Wheal Lovelace, East Wheal Virgin, and West Wheal Virgin. In 1824, this association was still further enlarged by the addition of the "United mines," consisting of two mines called Ale and Cakes and Poldory, both of which had been formerly extensively and profitably worked by separate companies.

The Consolidated "selt,"|| including the eight mines before men-

* The kaolin used at *Sèvres*, is procured from the quarries of Limoges, and is mixed with sand, sub-carbonate of soda, and nitrate of potash, (in proportions depending on the character of the materials;) to which is added pure alumine, when in a state of fusion. It requires an intense heat of wood fire to harden it. This substance is called *biscuit* before it is enamelled, and, when finished, is designated as *porcelain dure*, to distinguish it from the old fabric, formed from a mixture of glass and earths, called *porcelain tendre*. Many exquisitely beautiful models of celebrated statues, in biscuit, may be seen all over the continent, and more especially in Paris.

† It is estimated that about 37,000 tons of mineral matter are shipped annually from Devon and Cornwall, to the potteries. *China clays* sell at the works for £1 12s. 6d. per ton, and the *China stone* for 16s. per ton.

‡ For a more detailed and satisfactory account of these mines, see "Descriptive Notice of the Consolidated and United Mines," Mining Review and Journal, July, 1835; and Burr's "Elements of Practical Geology."

|| The ground included within the boundaries of a mine is called, provincially, a *solt*.

tioned, covers an area of about two square miles, and is surrounded on all sides by extensive and productive mines of either copper, or tin. The direction, or strike, of the main lodes of the Consols, (like those already mentioned,) is nearly due east and west, while the contre-lodes run north-east and south-west. Of the main lodes there are eight, or ten, averaging about five feet in width, but occasionally swelling out to nine feet. The cross, or contre-lodes, are about eighteen inches wide.

The ground included within the limits of the Consolidated and united selts, is generally barren in an agricultural point of view, but Mr. Burr says, "some idea, however, may be formed of the mineral wealth of this tract, when it is stated that within the last sixty, or eighty, years, it has yielded metallic produce to the amount probably of five, or six, millions of pounds sterling;* to which may be added, up to this time, a million and a half more.

These works employ constantly over three thousand persons. In 1830 the entire of the capital which had been invested in these mining operations had been repaid, and, from that time, the produce has gradually increased. The last returns I have seen, gave, as the value of the ores sold, the large sum of £145,717; the expenses for the same period were £102,000, leaving a clear profit of £43,717. The Treseveon mine, although yielding a much less amount of ore, is even still more profitable, owing to its being very dry, and requiring comparatively little machinery to raise the water from it. It returns to the adventurers about £50,000 per annum clear profit.

The average quantity of fine copper produced annually by the Consols, is about 1800 tons, or nearly one-tenth of all the copper furnished by Great Britain. The quantity of prepared ores, yielding rather more than nine per cent., is about 17,000 tons; to obtain which nearly 80,000 tons of trash are raised to the surface. A small quantity of tin ore is also raised.

The Redruth railroad passes through the whole extent of these mines, and affords a cheap and convenient means for the transportation of ores to Restrington creek, a tidal navigable stream, about four miles from the mines, from whence they are shipped to Swansea, in Wales; from the main, line branches are carried to the principal dressing floors and mine buildings, so that the ores from the mines, and the coal from Swansea, require no rehandling after they have been placed in the cars.

The "Great adit," already noticed in another part of this report, passes a short distance to the north of these mines, and serves as a general recipient for the waters pumped from the different lodes, and discharged through the branch adits.

According to Mr. Burr, these mines are about 1800 feet deep; the extent of horizontal under ground work is not less than 63 miles, while the aggregate depth of pit work, in 1835, was over 25 miles; these distances have probably been extended (to the present time) to at least 30 miles of vertical pit work. The same authority states that

* 1835. The United Mines have, within a few years, been detached, and are, at present, worked by a separate company.

the cost of working for discovery and exploration alone, for the twenty years preceding the year 1835, was, in round numbers, £300,000. At that time the machinery employed consisted of eight large steam engines, used for pumping, varying from 65 to 90 inch cylinders, and one of 30 inches, besides 8 steam engines of 20 inch cylinders, used for drawing ore and trash out of the mines. There was also a water wheel of 48 feet diameter, for pumping, one of 40 feet for driving machinery, and five smaller wheels (all of them being overshot,) for stamping and grinding ore, besides several *horse whims*, chiefly employed at the United mines. That gentleman estimated the engine power expended to be equivalent to 5000 horses; and adds, "that if it were exerted to its full extent, it would probably be equal to double that number."

When I visited the Consols, in 1841, the machinery had been increased by the erection of two large steam engines, and the enlargement of an old engine from a 70 to an 85 inch cylinder, and of another from an 85 to a 90 inch cylinder. Two other engines of 85 and 90 inches, respectively, were ready for use. I was kindly furnished at the mine with the annexed tabular statement, (marked D) to which I beg leave to refer for a minute account of all the details of the powerful pumping machinery employed at these mines.

The enormous amount of machinery, and consequent expenditure of money, connected with the working of the Consolidated and United mines, is owing, in a great measure, to their close proximity to the sea, and to the immense depth of the shafts below its surface, (about 1500 feet) which, of course, causes a great influx of water from that source.

*Copper, Copper Ores, and their Treatment.**

Copper is one of the most useful and the most anciently known of the metals. It has a peculiar red color, and a disagreeable taste and smell. Its density, which is 8.788 when first reduced and refined, is increased by cold hammering, and becomes equal to 8.878. It fuses at about 27° of Wedgewood's pyrometer, and crystalizes, by slow cooling, in the form of quadrangular pyramids. Copper is very malleable, whether cold, or hot, and of great tenacity when pure; when cast in the open air it emits vapors, which are condensed upon the surrounding bodies, and appear to be a mixture of the protoxide of copper and of metallic copper. In humid air it undergoes a change, and becomes covered with a green coating of hydrate and carbonate of copper.

Nitric acid, whether cold, or hot, acts upon it rapidly; sulphuric acid acts upon it only when concentrated, and at an elevated temperature.

Copper combines with oxygen in three different proportions, and with sulphur in two.

* In the preparation of this portion of the report, I have, besides my own MS. notes, consulted the following works, viz., Grande Dictionnaire de Technologie, Ure's Dictionary of Arts, Mining Review, De la Beche's Economic Geology, First Bulletin of the National Institute, and Cleaveland and Phillips' Mineralogy, to which reference is made for more minute information.

According to Mr. Berthier, some thousandths of potassium render copper very soft and malleable. This alloy is easily formed by melting refined copper with a little cream of tartar, or with carbon, which has absorbed a solution of carbonate of potash.

It occurs in nature under a great variety of forms:—

1st. In a native state, in regular crystals, *cubes*, *octahedrons*, or *dodecahedrons*, in grains, in stalactites, in branches, or filaments, and generally in amorphous masses. The largest mass ever known of native copper, is the "Ontonagon Rock," weighing 3,704 pounds, from the south shore of Lake Michigan, now in the Museum of the National Institute at Washington. In the "Consols" and "United mines," Cornwall, it is found generally in the cross courses, enveloping sulphuret of copper, and sometimes in the fissures of the killas, near the lodes.

2nd. Sulphuret of copper, (hany) or vitreous copper, (brochant) of which a great many varieties are known. It is very rich, yielding, when pure, about 80 per cent. of copper. It is often crystalized, and presents a shining lead color, and is sometimes iridescent; but its color is usually dark. Beautiful crystals of this ore are found in St. Just and Cambrea mines, Cornwall.

3rd. Copper pyrites, pyritous copper, or bi-sulphuret* of copper, strongly resembles sulphuret of iron; but the latter is less pale in color, is harder, and gives fire more readily with steel. It often presents the most rich and beautiful rainbow colors. When pure, it yields 30 copper, 37 sulphur, 33 iron. The best Swedish pyrites give 63 copper, 25 sulphur, 12 iron. This is by far the most abundant and common ore of copper. It is found chiefly in primitive and transition districts, but sometimes in secondary rocks, and is associated with the other ores of copper, spary, and magnetic iron, oxides of tin and arsenic, sulphurets of zinc, lead, and iron, fluete of lime, and quartz. It is called yellow ore by the miners, and is the principal ore worked in Sweden, Great Britain, and Ireland, Cuba, Chili, at Cressy, in France, and also at Mansfield, in Germany, where it is found in a slaty bed about 6 inches thick, which is called *cupreous schist*, which yields only about 1½ per cent. of copper, is occasionally argentiferous, and has been profitably worked for centuries. It contains many fossil fish converted into copper pyrites. Here is also found fossil monitors.

4th. Gray copper. Its composition is variable, but consists essentially of copper, iron, antimony, arsenic, and sulphur. In the gray copper of Guadalcand, in Spain, Vauquelin found 10 per cent. of platina. According to Ure, it contains silver, and is often profitably worked on that account. It occurs in primitive mountains, and is often mixed with red silver, copper pyrites, and crystalized quartz. Tennantite is composed of copper, iron, sulphur, arsenic, and silic.

5th. Oxide of copper. The red, or protoxide, is of a deep red color; it occurs compact and crystalized, and is sometimes in filaments; it dissolves in muriatic acid without effervescence, but it effervesces with nitric acid. It is very rich, but not abundant, yielding, according to Chenevix, 88.5 copper, 11.5 oxygen. Cleaveland says it is never

* Allan, De la Beche. Beautiful specimens of azure copper are found at Cressy.

found in large masses. I have, however, seen, in the Museum of Economic Geology, London, a very large rock of it, yielding over 80 per cent. of metal.

6th. The black oxide is of a velvet black color, inclining sometimes to brown, or blue; it acquires a metallic lustre on being rubbed. It is a true peroxide, and consists of copper 80, oxygen 20. It is found in Cornwall in the form of a black powder, and is there called *podre*.

7th. Hydrosilicate of copper. *Chrysocolla*, (Phillips.)

8th. *Diopase*, a rare and beautiful emerald malachite, consisting of oxide of copper, carbonate of lime, silica, and water.

9th. Carbonate of copper, blue and green, sometimes found in beautiful crystals, and is often valuable as a gem. It has been sometimes manufactured into large and valuable vases and tables, which have formed the objects of imperial presents.* The green and blue carbonates are found in beautiful crystals at Chessy.

10th. Sulphate of copper.

11th. Phosphate of copper.

12th. Muriate of copper.

13th. Arseniate of copper.

The Treatment of Copper Ores.

The principal copper ores are arsenical, or sulphurous, or a mixture of both. The reduction of copper requires numerous operations, on account of the great affinity which exists between this metal and sulphur, and arsenic. These operations, often multiplied, are simple in themselves, and are reduced to calcinings, roastings, and meltings, which are repeated until its purification is sufficiently advanced. Copper obtained from these ores is never absolutely pure. It contains arsenic, antimony, and sometimes tin in small quantities, and cannot be employed in the alloys of silver and gold.†

The proportion of metallic copper contained in ores, is sometimes so small, that it can be profitably reduced only in places where, as in Sweden, fuel is cheap.

The treatment of different ores should vary with their qualities, but the processes are essentially the same; but, as the limits of this paper will not permit me to specify all the modifications in detail, I shall restrict myself to designating the operations to which pyritous ores, containing but a small proportion of sulphur, and gray, or argentiferous, copper, are subjected in different countries.

The treatment of the first two varieties begins with a sorting by hand, which consists in putting aside all the fragments as large as hens' eggs, and from amongst them to separate and reject the stony pieces. Those which remain are broken according to their size, and all reduced to fragments not larger than walnuts. Another selection, or picking over, is then made, for the purpose of sorting them according to their richness, and rejecting those which are altogether stony.

* A large and beautiful malachite table may be seen in Hamilton Palace, a very large and costly vase at Windsor Castle, and another at the Palace of the King of Holland, in Brussels, all presents from the Emperor Alexander.

† Copper used for this purpose is obtained by cementation, a process to be described hereafter.

The others form three qualities, viz., 1st, fragments of pure ore; 2nd, fragments slightly intermixed with foreign matter; and 3rd, fragments of the poorest kind. This sorting is more, or less, rigorous, according to the expense of the subsequent treatment, consisting of the price of fuel, manual labor, transportation, &c.

No. 1, is broken on a cast-iron bed, by means of a batte, or flat beater, formed of a piece of iron six inches square and one inch thick, adapted to a wooden handle, into fragments not larger than filberts. The selection and breaking are usually done by women and children. When this is completed, the ore is ready for calcination. No. 1, is called *prills* in Cornwall. No. 2, the dredge ore, as it is termed, is spalled by the batte, and then sent to the workshops to be riddled (sifted) and washed. No. 3, (the *halvans*, or leavings,) is sent to the crushing mills.

When the ores are not sufficiently pure to be separated by selection, the remaining operations are based upon the relative specific gravities of the materials subjected to dressing, and they are ground to various degrees of fineness, so as to render the ores separable from the foreign matter, by the agency of running water. Steam stamping mills are usually employed for this purpose, when the ores are finely disseminated through the vein stone, or when the matter of the gangue is very hard.

In Cornwall, the ores at many establishments are broken by means of crushing mills, instead of being broken by battes. As the crushed ore falls from the crushing rollers, or cylinders, it is received in an inclined cylindrical sieve, which, by turning on its axis, permits the larger sized ore to slide down to the bottom, while the smaller passes through its meshes. The pieces which do not pass through the sieve are returned to the crushers.

The small pieces of ore separated in the first selection, and from which all fragments larger than hens' eggs were sorted, are then sifted on an iron wire riddle; the intervals between the wires are about five lines. A workman, by repeated shaking of the riddle, filled with ore, and immersed in running water, separates it into three parts: 1st, the fine particles, which are carried off by the current, and deposited in a distant portion of the pool;* 2nd, the fragments, which are deposited under the riddle; 3rd, the largest pieces which remain on the riddle. The last are spread out on a table, and assorted by hand. The fragments not rejected as too poor are then broken, and re-submitted to the above named operations.

The ore deposited under the riddle is re-sifted, and the No. 2, broken when the separation into three classes was made, is added. The meshes of the sieve are from twenty to thirty to the square inch. The workman who manages it shakes it by two handles, with a compound motion, both round and vertically, immersed in a shallow pool of water, above which it is never lifted. The finest particles pass through the sieve; those that remain above it are divided, by the difference of their specific gravities, into three parts. The lightest, which is above, contains so little metal that it is thrown away; the middle

* This pool, or basin, is called a "buddle," and the process is termed "buddling."

portion is sent to the stamping mills, and the lower part, the richest of all, accumulated during two, or three, siftings, needs only to be placed on a slightly inclined plane, and to be stirred with a rake while it is washed by a small stream of water flowing gently over it. This operation, which is called "jigging," is, at most of the well regulated Cornish mines, performed by machinery. A rectangular sieve is suspended in a box of the same shape, filled with water, and a vibratory motion is communicated to the sieve by a working rod, connected either with a water wheel, or a steam engine, as may be most convenient. The old method is still followed on the continent, and may still be seen in England at the smaller mines.

The fine ore passed through the sieve is separated into two parts by stirring in water. The richest, fallen to the bottom, requires but one washing. Finally, the different classifications of ores sent to the crushing and stamping mills, and separated from the non-metaliferous substances with which they were mixed, by stirrings and washings on inclined planes, constitute the *prepared ores*, ready for sale and reduction; while the stony parts, which always retain some ore, are thrown away.

It occasionally happens that tin ores are mixed with the copper ores, and, in consequence of their great specific gravity, are accumulated at the head of the buddle. When this is the case, they are roasted, and treated like tin ores; and the copper pyrites, being converted into sulphates in the calcining furnaces, are dissolved, and separated by cementation.

As all the copper ores mined in Cornwall and Devon are taken to Swansea for reduction, owing to the want of fuel in the mining districts, they are sold at the mines to the agents of the smelters, who pay for the transportation to the furnaces. Sales take place, weekly, at Truro, Redruth, or Pool, by what is called "ticketing." It is usual when the results of the last sale are published, says M. De la Beche, to announce those that will take place at the two next ticketing days, distinguishing the mines, and the number of tons of ore (of 21 cwt.,) which each intends to sell. The system of selling ores, by ticketing, has prevailed in Cornwall for the last one hundred and twelve years; and is thus described by Borlase, as practiced in his time: "A quantity being sorted, cleaned, and divided into heaps, according to the quality of the ores, the agents of the copper companies of Wales and Bristol, (who reside at Truro and Redruth,) upon notice given, attend to sample the ore, and each sampler having taken from each pile as much as is sufficient for assaying and ascertaining the value of that pile, a day is appointed, by joint consent of seller and buyer, at such distances as may give the sampler time to repeat and verify his assays for the sale of the copper. On the fixed days, each of the samplers attends, and produces a *ticket*, or written paper, sealed up, in which is expressed the price which each sampler will give for the ore; he who bids most has the ore." This plan is essentially the same as that followed at the present time.

M. De la Beche observes, "that the mode of assaying copper ores in Cornwall, is usually conducted in a somewhat rough manner, and

accurate results can scarcely be expected from it. Indeed, chemistry has, as yet, made little progress amongst the assayers of Cornwall." The assays are conducted by the dry mode, and are somewhat analogous to the process of reduction on a large scale, and are nearly the same as those described by Price, sixty years ago. The humid assay is the most exact, but it requires more skill and time. Ure gives several methods, (dry and wet.) The following, for a dry assay, is, perhaps, as good as any other: "A portion of the mixture, (prepared ore) tried by the blow-pipe, will show, by the garlic, or sulphurous, smell of its fumes, whether arsenic, sulphur, or both, be the mineralizers. In the latter case, which often occurs, 100 grains, or 1000 grains, of the ore are to be mixed with the one-half its weight of sawdust, then imbued with oil, and heated moderately in a crucible, till all the arsenical fumes be dissipated. The residuum, being cooled and triturated, is to be exposed in a shallow earthen cup to a slow roasting heat, till the sulphur and charcoal be burned away; what remains being ground and mixed with half its weight of calcined borax; one-twelfth its weight of lamp-black, next, made into dough, with a few drops of oil, is to be pressed down into a crucible, which is to be covered with a luted lid, and to be subjected, in a powerful air furnace, first to a dull red heat, then to vivid ignition for twenty minutes. On cooling and breaking the crucible, a button of metallic copper will be obtained. Its color and malleability indicate pretty well the quality, as does its weight the relative value, of the ore. It should be cupelled with lead, to ascertain if it contain silver, or gold.

If the blow-pipe trial showed no arsenic, the first calcination may be omitted, and if neither sulphur nor arsenic, a portion of the ground ore should be dried, and treated directly with borax, lamp-black, and oil. It is very common to make a dry assay of copper ores, by one roasting, and one fusion, along with three parts of black flux; from the weight of the metallic button the richness of the ore is inferred.

Ores of the oxide of copper are easily analyzed by solution in nitric acid, the addition of ammonia to separate the other metals, and precipitation by potash. The native carbonate is analyzed by calcining 100 grains, when the loss of weight will show the amount of water and carbonic acid; the latter may be found by expelling it from another 100 grains, by digestion in a grain weight of sulphuric acid. The copper is finally obtained in a metallic state, by plunging bars of zinc into the solution of the sulphate."

Berthier, (*Traité des Essais par la Voie Séche*, tom. ii, p. 474,) describing assays of the sulphurets of copper, mixed with iron, (such as the workable ores usually are,) and after noticing the roasting, in which it is necessary to stir the particles of ore continually, so that all should come in contact with the air, says, "that when the roasting is somewhat advanced, the heat should, from time to time, be increased to a bright red, in order to make the sulphurets and sulphates act upon each other, and produce reciprocal decomposition. When the sulphurous acid ceases to be disengaged, a white heat should, for some minutes, be produced, to decompose the last trace of sulphate. When

the roasting has been conducted with care, the assay, melted with three, or four, times its weight of black flux, will give nearly all the copper which it contains, and the iron will remain disseminated through the slag, partly in a metallic state, and partly in a state of oxide. If the roasting has been imperfect, the slag will be sulphurous, and retain copper in combination. With poor copper ores, the slag also retains a good deal of copper, but this loss may be greatly decreased by adding about one part of borax to the black flux, in order to render the scoriæ more liquid; but it is preferable, in such cases, to assay by the humid way;" which, indeed, Berthier strongly recommends for ores of this class, when they are mixed with much iron.

The first operation to which prepared cupreous pyrites are subjected, as a preliminary to reduction, is that of calcination, with the view of depriving them of a portion of their sulphur and arsenic. For this purpose the ore is piled up in furnaces, or in the open air. In the first case, it is placed in alternate layers, with the fuel in furnaces, resembling lime-kilns, or formed simply of a square case of masonry. This is the Bohemian method. The roasting continues for three weeks; the fire is kindled below; by degrees the sulphur is disengaged, and lost in the air. A portion of the sulphur, in burning, serves gradually to heat the whole mass, and the combustion extends slowly to the upper parts.

In the second case—that of calcining, in heaps, in the open air—the ore is piled up in great masses in the form of truncated quadrangular pyramids, with the fuel at the bottom. In the centre of the mound is a wooden chimney, with charcoal at the bottom; an opening is left in the middle of each side, through which a current of air is admitted under the wooden chimney, by which means ignition is produced, when fire is thrown down the chimney, and combustion supported. This pyramid is covered with mortar, sods, &c., and hemispherical cavities are dug on the upper surface, for the purpose of receiving the sulphur, which, during the roasting of ore, arrives liquefied at the surface. This method of roasting, which is practicable only when the ore is very sulphurous, is employed at Chessy, near Lyons, in France, and at Goslar, in the Lower Hartz. It lasts about six months, at the end of which period the sulphur ceases to escape. The mass is then left to cool, and when this is accomplished the ore is fit for smelting.

In the calcining operations, the volatile substances are mostly disengaged in a gaseous form, while the metals, owing to their strong affinity for oxygen, become oxidized. In melting, the earthy matters unite with these oxides, and form slags, which float on the surface of the molten metal.

When the pyritous copper is sufficiently calcined,* whether in the open air, or in kilns, it is carried to a peculiarly shaped furnace, called, in France, "*fourneau à manche*," or elbow furnace, much resembling

* When properly calcined, the ore scarcely changes weight, inasmuch as it gains as much oxygen as it loses of volatile matter, and is reduced to the state of a *black powder*, owing to the oxidation of the iron.

the Scotch furnace used in Cumberland for smelting lead; this furnace is charged with a mixture of charcoal and prepared ore, earthy matter being sometimes added as a flux, to render the gangue fusible. The scoriæ of previous meltings are also added; they assist the fusion, and always furnish a little copper which they had retained. In proportion as the material melts, it runs to the bottom of the furnace, which is formed something like a pocket, or large crucible. This receptacle is lined with a mortar made of burnt and raw clay and charcoal; when it is filled with liquefied substances, the workmen rake the surface with an iron rable, and they continue to remove the scoriæ till the pocket is filled with rich metallic matter. The last scoriæ removed contain particles of metal, and are re-melted in the succeeding operations. The pocket is now emptied into a vat, or bath, lower down. From this bath the scoriæ, floating on the top, are removed, to be again melted with ore. The surface of the melted metal is then sprinkled with water, and a layer, hardened by cooling, is removed. The surface is again sprinkled, and another layer detached, and so on until the whole is exhausted. All these strata, which are called *mattes*, are taken to the roasting furnaces.

When these mattes have been sufficiently roasted, (the object of which is to still further oxidize the iron,) they are removed to a reverberatory smelting furnace; the results of this fusion are scoriæ, new mattes, less impure than the preceding, and *black copper*, (oxide and sulphuret of copper,) which is laid aside to be refined.

The second mattes are taken back to the roasting furnace, there melted anew, to be again roasted. In these operations, they again give scoriæ, mattes more pure, and black copper, which are removed to the refinery. In continuing this process, all the ore is successively converted into copper and scoriæ; and, after the latter have been as much as possible exhausted, as shown above, they are thrown away. Those that are rejected seldom contain more than half of one per cent. of metal, as is shown by comparing the amount of reduction with the selling assay. The foregoing method is followed at Chessy, and may be called the continental system.*

Before proceeding to describe the process of refining, I will explain another mode of treatment for prepared mineral after the first calcination.

When the raw ores do not contain a sufficient proportion of iron pyrites, to furnish enough sulphur to sustain spontaneous combustion for a sufficient length of time, it becomes necessary to have recourse to other means, and to operate as they do at Swansea, where the whole treatment of the ore is in reverberatory furnaces. The calcinations and the fusions succeed each other in the following order, viz., first, calcination of the ore; second, melting of the calcined ore;

* In the "Annales du Comptoir des Mines de Fer," in Sweden, for 1834, it is said, "that hitherto the Falun copper ores have been roasted in rectangular spaces, but some recent experiments have satisfactorily shown that reverberatory furnaces are the best. The ore must be reduced to the state of a coarse powder; in which condition it requires only eighty hours for completing the process. H. C. Strom, State officer of mines in Norway, thinks differently, and gives the decided preference to the continental method, as will be shown in another part of this paper.

third, calcination of the first matte; fourth, melting of the calcined matte; fifth, calcination of the second matte; sixth, melting the second calcined matte; seventh, roasting the black copper, (in many establishments they repeat the roasting four times in succession, in which case one calcination, and one melting are omitted;) eighth, refining the copper. Finally, besides these operations, two others are generally performed, the re-melting of the portion of the scoriæ of the second operation, which retains metallic granules, and the melting of the scoriæ of the fourth operation for the purpose of concentrating the particles of copper in the scoriæ.

The ore is more carefully prepared than on the continent. It is reduced into pieces about the size of filberts, and then spread on the bottom of a reverberatory furnace to calcine. The furnace is heated gradually, taking care not to push the temperature to the point of melting, or agglutinating, the pieces; and they stir the ore very frequently, in order to renew the surface, and to multiply points of contact with the flame. This calcination generally continues for twelve hours, at the end of which time a portion of the sulphur and arsenic is disengaged. The ore absorbs oxygen, is reduced to a black powder, and still contains much sulphur and arsenic. When the calcination is finished, the materials are *dumped* into a vault below the furnace. In this state the ore is ready for a first fusion, which operation is performed in a common reverberatory furnace. Scoriæ and different fluxes are added, according to the nature of the ore. After a heating of four, or five, hours the fusion is completed. During the melting the mass is repeatedly stirred with a rake, to aid in the disengagement of the slag, which is removed by a rake as often as it rises to the surface. They add a fresh charge of calcined ore, again remove the scoriæ, and add a third charge; this time the scoriæ are carefully skimmed off; the stopple is removed, (or the luting pierced,) and the molten metal runs into a pool of water; in falling into this liquid, it hardens in separate granules, which remain red, at the bottom of the basin. The granules thus obtained, present, in their fracture, a steel grey color, and a metallic lustre. By this process the copper is concentrated by the separation of much foreign matter with which it was combined; but the matte, in this state, is far from having attained the necessary degree of purity. It contains but 33 per cent. of copper, much sulphur and arsenic, and some iron; in consequence of which it must be several times calcined and melted in a reverberatory furnace, according to the composition of the ore. These calcinations and fusions are ordinarily repeated eight, or ten times, and it is granulated, in order that it may be more easily calcined. At each melting the slags are skimmed off, but they are removed, to be melted with a first fusion, because they always retain a small quantity of metal, but little intermixed with foreign matter.

If the second fusion be granulated, it is called *fine* copper, but if run into pigs it is termed *blue* copper; it contains about 60 per cent. of copper.

The greater, or less, degree of impurity renders necessary successive meltings and calcinations, more, or less, numerous. These operations

must be multiplied until the grains are sufficiently refined; which is ascertained by the color, by rolling, cutting in two, and by bending till they break. The color of the fracture indicates the suitable degree of purity. The next process is that of roasting, as we shall see below.

When the grains contain enough silver to justify its extraction, they are melted with three times their weight of lead.

Commonly, when the ore contains silver, which is often the case with grey copper, it is imperfectly melted before calcination, with the object of separating a great part of the gangue in the state of scoriæ. This operation produces a matte, consisting of sulphur, copper, iron, and silver. This matte is then calcined, and melted with plumbiferous materials, by which fusion three products are obtained, 1st, a matte, which must be again calcined; 2nd, argentiferous, plumbiferous copper, which is liquated; 3rd, argentiferous cupreous lead, which is cupelled. Liquation and cupellation produce impure copper and silver.

In order to liquate the copper, or sweat out the silver, it is run into flat pigs, which are subjected to liquation at a temperature a little above that of red heat for two, or three, days, in the same manner that bronze is refined. These pigs, which are called *liquation cakes*, are arranged horizontally on iron bars above a cast-iron trough. The lead is first melted; it falls from the pigs in small drops, carrying with it the silver; but all the lead does not escape.

This lead is afterwards converted into litharge, in order to extract from it the silver.

The cakes of copper are thus left all riddled, as it were, with holes, resulting from the empty spaces left by the melted lead; and having become much less fusible, they require a great augmentation of heat, in order to get rid of the remainder of the lead. The cakes of liquation, or what has remained of them, are then melted and granulated, calcined, and again melted, until the metal is sufficiently soft and malleable. It is then run into a mass. In this state it is fit for the refinery; but before being melted for refining it is broken into pieces. This is the process usually observed in treating the sulphuret of copper, or the grey copper ore.

To be Continued.

Extracts from an article on the Practice of the Calotype Process of Photography. By GEO. S. CUNDELL, Esq.

4. The Daguerréotype plate owes its sensibility to the iodide of silver, obtained by exposing the metal to the vapor of iodine. The same compound, iodide of silver, is the foundation of the calotype also; but it is obtained by a "humid" process, by the decomposition of nitrate of silver, upon the surface of paper, by means of a solution of the iodide of potassium. It has been found that paper so prepared, when treated with gallic acid, becomes exceedingly sensitive; and that upon the slightest exposure to daylight, under particular treat-

ment, it will become perfectly black and opaque. Hence its fitness and adaptation to receive the delicate, but feeble, impressions of the images formed in the camera obscura, which imprint upon it what has been called a "negative" picture, having the lights and shadows of nature reversed. This "negative," when fixed and rendered permanent, is used as a matrix, and, by a simple and well known process, a great number of impressions may be photographically printed from it, representing objects not only in true light and shadow, but true also in relation to right and left.

5. Before any thing good can be produced in calotype, the operator must be provided with a properly constructed camera obscura. The cameras met with in the shops are generally made after the French model, with nominally achromatic lenses, of the plano-convex figure, and of a short focus. Without presuming to disparage these, which, no doubt, will give a portion of well defined picture in the centre of the field, sufficient for a single portrait, I would venture to recommend, on the authority of Dr. Wollaston, a lens of the meniscus figure, having the radii of its curves in the proportion of two to one.

6. He has shown, in an essay on the particular subject, (in the Philosophical Transactions for 1812,) that the miniscus figure, *when properly "stopped,"** is peculiarly adapted to the camera obscura, from its property of producing a comparatively *flat* and focal field throughout the picture, when the picture is received upon a plane surface (§6.) Without undervaluing the advantage of corrected aberration, it may well be doubted whether you do not lose more than you gain by the plano-convex figure, even though achromatic, from the impossibility of bringing its picture, when of any extent, to a tolerable focus. Achromacy, is, no doubt, desirable, but in calotype, where the image is not to be magnified, it is, by no means indispensable, as any one may prove who fairly tries the experiment; and the expense of a really achromatic lens of an adequate aperture must put it in a great degree out of the question. Perhaps the best substitute for it would be a lens of *blue* glass, which would transmit nearly the whole of the chemical rays to a common focus. But of whatever figure the lens may be, and of whatever color, it will not be unimportant that the focus be considerably longer than that commonly used.

7. In order that a picture in perspective may be seen with truth and satisfaction, it is necessary that it be seen from a particular point of view, in which the eye has the same relation to the picture that it would have to the object represented. The picture must subtend at the eye the same angle as the object, and unless it do, it will always look more, or less, distorted and unnatural. The principle is well illustrated in the diorama, the illusion and the charm of which depend in no small degree upon the placing of the spectator at the proper height and distance; but the principle applies to all pictures in per-

* His improvement is a very striking one, and it seems odd, that the principal part of it, upon which the effect chiefly depends, his mode of stopping out, and admitting the light, is precisely the part which (so far as I am aware) has been entirely overlooked in practice, and in every popular treatise on the subject.

spective, and to camera pictures in particular, which are wonderfully improved when placed at the proper distance from the eye. Calotype pictures are not intended to be looked at, and are seldom viewed at a shorter distance than twelve inches; and in order that such a picture viewed at that distance, may be seen in *true* perspective, the lens of the camera must be of twelve inches focus. In portraiture the effect may be less obvious than in architecture, or in general subjects, but there can be no doubt that a portrait taken by a lens of six inches focus, viewed at the distance of twelve inches, would lose a great part of any truth, or likeness, it might really possess.

8. For these reasons the lens ought not perhaps to be less than 12 inches focus, and, if mounted in the manner shown in Plate II, fig. 4, it will be found to be generally convenient.

There is no novelty in this construction, unless perhaps in the introduction of the diaphragms A B, and C D, and in the elongation of the mouth-piece, both of which are useful in protecting the picture from all external light, except that which emanates from the objects to be copied; the rays from the direction *b*, being intercepted at B, and those from *d*, at D. The paper is placed between two plates of glass, introduced at the open end G H, and these are pressed together and secured in their place by means of a detached door having a revolving bar behind it, the extremities of which work in grooves in the sides of the outer case.*

9. By reference to the diagram, it will be seen that by means of the diaphragm, or "stop," E F, the rays from the barb of the arrow are excluded from the upper, and received only upon the lower, half of the lens, upon which they fall at a comparatively high and *equal* angle of incidence. They are thus less refracted than they would otherwise be, and their focus is not only sharpened but elongated. By this means the picture, instead of being formed in the usual curve, is formed much nearer to a straight line in the plane of the paper placed to receive it.

10. A lens of twelve inches focus ought to have an aperture of 2.4 inches. The diaphragm at E F, (in which the principal virtue of the instrument resides,) ought to be placed 1.5 inch in advance of the lens, and its opening ought not to exceed 1.2 inch. By using one of a smaller opening, a much finer image will be obtained, but at the sacrifice of light; at short distances, however, on account of the increasing divergency of the rays, only a small opening, admitting the mere centres of the pencils, can be used with advantage. The size of the plate glasses may be eight inches by six.

11. It must be observed of this camera, and of all others which are not achromatic, that there is a peculiar adjustment required of the focus, the not attending to which has been the cause of much failure and disappointment. The instrument must be adjusted to what has been appropriately called the *chemical* focus, which differs materially from the optical, or visible, focus, as will be seen by the following table, in which the two are contrasted; the former being about one-

* The instrument, much improved, may be had of Mr. Dennis, No. 118 Bishopsgate street Within.

thirty-sixth part shorter than the latter for parallel rays, and for diverging rays in proportion.

Principal focus = 12 inches.*			
Distance of object.	Visible focus.	Chemical focus.	Difference.
Feet.	Inches.	Inches.	Inch.
5	15.00	14.49	0.51
6	14.40	13.93	0.47
7	14.00	13.55	0.45
8	13.71	13.28	0.43
9	13.50	13.09	0.41
10	13.33	12.93	0.40
12	13.10	12.71	0.39
15	12.86	12.47	0.39
18	12.70	12.32	0.38
24	12.52	12.16	0.36
50	12.24	11.90	0.34
100	12.12	11.78	0.34

12. It will be found convenient to insert one, or more, strips of white wood in the sliding part of the camera, as shown in the drawing, and to graduate these with the foci produced by the different "stops" used at E F. This graduation is best done by first accurately determining the visible foci (by daylight) of two fiducial points near the extremities of the scale, by means of a test object, and a magnifier, and then setting off by measure the calculated differences; thus, for a twelve inch lens,

Aperature 0.9 in.	Chem.	150 ft.	45	24	15	10	8	5
Optical		30	18	12	9	7	6	
		150 ft.	30	18	12	9	7	5
		45	24	15	10	8	6	

When the instrument is thus graduated, the focus may be set in an instant, with an accuracy which is quite unattainable by the unassisted eye, by merely measuring the distance of the object, if near, or by guessing at it, if out of reach.

13. To produce a calotype picture there are five distinct processes, all of which, except the third, (§25) must be performed by candle light; they are all very simple, but, at the same time, all of them require care and attention. The first, and not the least important, is

14. *The Iodizing of the Paper.*—Much depends upon the paper selected for the purpose; it must be of a compact and uniform texture, smooth and transparent, and of not less than medium thickness. The best I have met with is a fine satin post paper, made by "R. Turner, Chafford Mill." Having selected a half sheet without flaw,

* For lenses of a different focus, the graduation will be in proportion, at proportionate distances; thus, for a lens of six inches, the spaces will be one-half the above, at half the distances.

or water mark, and free from even the minutest black specks, the object is to spread over its surface a perfectly uniform coating of the iodide of silver, by the mutual decomposition of the two salts mentioned in §4. There is considerable latitude in the degree of dilution in which these salts may be used, and also in the manner and order of their application; but as the thickness and regularity of the coating depend upon the strength of the solution of nitrate of silver, and upon the manner in which it is applied, I think it ought, by all means, to be applied first, before the surface of the paper is disturbed; and I am inclined to believe, that if the solution be used of double the strength suggested by Mr. Talbot, the coating will be found more perfect and continuous, and will produce better pictures. I use, accordingly, a solution of the strength of thirty grains to the ounce of distilled water.

15. The paper may be pinned by its two upper corners to a clean dry board a little larger than itself, and, holding this nearly upright in the left hand, and commencing at the top, apply a wash of the nitrate of silver *thoroughly, evenly, and smoothly*, with a large soft brush, taking care that every part of the surface be thoroughly wetted, and that nothing remain unabsorbed in the nature of free, or running, solution. Let the paper now hang loose from the board into the air to dry, and by using several boards time will be saved.

16. The nitrate of silver spread upon the paper is now to be saturated with iodine, by bringing it in contact with a solution of the iodide of potassium; the iodine goes to the silver, and the nitric acid to the potash.

17. Take a solution of the iodide of potassium of the strength of 200 grains to a pint of water, to which it is an improvement, analogous to that of M. Claudet, in the Daguerriotype, to add fifty grains of common salt. He found that the chlorinated iodide of silver is infinitely more sensitive than the simple iodide, and by this addition of common salt, a similar, though a less remarkable, modification is obtained of the sensitive compound. Pour the solution into a shallow flat bottomed dish, sufficiently large to admit the paper, and let the bottom of the vessel be covered to the depth of an eighth of an inch. The prepared side of the paper having been previously marked, is to be brought in contact with the surface of the solution, and, as it is desirable to keep the other side clean and dry, it will be found convenient, before putting it in the iodine, to fold upwards a narrow margin along the two opposite edges. Holding by the upturned margin, the paper is to be gently drawn along the surface of the liquid until its lower face be thoroughly wetted on every part; it will become plastic, and in that state may be suffered to repose for a few moments in contact with the liquid; it ought not, however, to be exposed in the iodine dish for more than a minute altogether, as the new compound, just formed upon the paper, upon further exposure would gradually be re-dissolved. The paper is, therefore, to be removed, and, after dripping, it may be placed upon any clean surface with the wet side uppermost until about half dry, by which time the iodine solution will have thoroughly penetrated the paper, and have found out and saturated every particle of the silver, which it is quite

indispensable it should do, as the smallest portion of undecomposed nitrate of silver would become a black stain in a subsequent part of the process.

18. The paper is now covered with a coating of the iodide of silver, but it is also covered, and indeed saturated, with salt-petre, and with the iodide of potassium, both of which it is indispensable should be completely removed. To effect the removal of these salts, it is, by no means, sufficient "to dip the paper in water," neither is it a good plan to wash the paper with any considerable motion, as the iodide of silver, having but little adhesion to it, is apt to be washed off; but the margin of the paper being still upturned, and the unprepared side of it kept dry, it will be found that, by setting it afloat on a dish of clean water, and allowing it to remain for five, or ten, minutes, drawing it gently now and then along the surface to assist in removing the soluble salts, these will separate by their own gravity, and (the iodide of silver being insoluble in water,) nothing will remain upon the paper but a beautifully perfect coating of the kind required.

19. The paper is now to be dried, but while wet, do not on any account touch, or disturb, the prepared surface with "blotting-paper," or with any thing else. Let it merely be suspended in the air, and, in the absence of a better expedient, it may be pinned across a string by one of its corners. When dry it may be smoothed by pressure. It is now "iodized," and ready for use, and in this state it will keep for any length of time if protected from the light. The second process is that of exciting, or

20. *Preparing the Paper for the Camera.*—For this purpose are required the two solutions described by Mr. Talbot, namely, a saturated solution of crystalized gallic acid in cold distilled water, and a solution of the nitrate of silver of the strength of fifty grains to the ounce of distilled water, to which is added one-sixth part of its volume of glacial acetic acid. For many purposes these solutions are unnecessarily strong, and, unless skilfully handled, they are apt to stain, or embrown, the paper; where extreme sensitiveness, therefore, is not required, they may with advantage be diluted to half the strength, in which state they are more manageable, and nearly as effective. The gallic acid solution will not keep for more than a few days, and only a small quantity, therefore, should be prepared at a time. When these solutions are about to be applied to the iodized paper, they are to be mixed together, in equal volumes, by means of a graduated drachm tube. This mixture is called "the gallo-nitrate of silver." As it speedily changes, and will not keep for more than a few minutes, it must be used without delay, and it ought not to be prepared until the operator is quite ready to apply it.

21. The application of this "gallo-nitrate" to the paper is a matter of some nicety. I doubt if it be possible to apply it successfully with *brushes*; and it appears to me that one application of the gallo-nitrate as completely unfits a brush for a second, as the dipping of a sheet of paper in ink would unfit it for writing upon. It will be found an improvement to apply it in the following manner:—Pour out the solution upon a clean slab of plate glass, diffusing it over the surface

to a size corresponding to that of the paper. Holding the paper by a narrow upturned margin, the sensitive side is to be applied to the liquid upon the slab, and brought in contact with it by passing the fingers gently over the back of the paper, which must not be touched with the solution.

22. It has been recommended at this stage, "to let the paper rest for half a minute, and then to dip it into water, and dry it with blotting paper," which, I apprehend, has been the fruitful cause of much failure and disappointment, by the staining and embrowning of the paper, and by the partial removal of its sensitive surface.

23. As soon as the paper is *wetted* with the gallo-nitrate, it ought instantly to be removed into a dish of water; five, or ten, seconds, at the most, is as long as it is safe, at this stage, to leave the paper to be acted upon by the gallo-nitrate; in that space of time it absorbs sufficient to render it exquisitely sensitive. The excess of gallo-nitrate must immediately be washed off, by drawing the paper gently several times under the surface of the water, which must be perfectly clean, and, being thus washed, it is finished by drawing it through fresh water, two or three times, once more. It is now to be dried in the dark in the manner described in §19, and when surface-dry, it may either be placed, while still damp, in the camera, or in a port-folio, among blotting paper, for use. If properly prepared, it will keep perfectly well for four and twenty hours at least, preserving all its whiteness and sensibility.

24. The light of a single candle will not injure the paper at a moderate distance; but the less the paper, or the exciting solution, is unnecessarily exposed, even to a feeble candle-light, the better. Common river, or spring, water answers perfectly to *wash* the paper, distilled water being required for the silver solutions only. Stains of "gallo-nitrate," while recent, may be removed from the fingers by a little strong ammonia, or by the cyanide of potassium. The third process is that of

25. *The Exposure in the Camera*,—For which, as the operator must be guided by his own judgment, few directions can be given, and few are required. He must choose, or design, his own subject; he must determine upon the aperture to be used, and judge of the time required, which will vary from a few seconds to three, or four, minutes. The subject ought, if possible, to have a strong and decided effect; but extreme lights, or light colored bodies, in masses, are, by all means, to be avoided. When the paper is taken from the camera, very little, or, more commonly, no trace, whatever, of a picture is visible until it has been subjected to the fourth process, which is

26. *The bringing out of the Picture*,—Which is effected by again applying the "gallo-nitrate" in the manner directed in §21. As soon as the paper is wetted all over, unless the picture appear immediately, it is to be exposed to the radiant heat from an iron, or any similar body, held within an inch, or two, by an assistant. It ought to be held vertically, as well as the paper, and the latter ought to be moved, so as to prevent any one part of it becoming dry before the rest.

As soon as the picture is sufficiently brought out, wash it immediately in clean water to remove the gallo-nitrate, as directed in § 23; it may then be placed in a dish by itself, *under* water, until you are ready to fix it. The most perfect pictures are those which "come out" before any part of the paper becomes dry, which they will do if sufficiently impressed in the camera. If the paper be allowed to dry before washing off the gallo-nitrate, the lights sink and become opaque, and if exposed in the dry state to heat, the paper will embrown; the drying, therefore, ought to be *retarded*, by wetting the back of the paper, or the picture may be brought out by the vapor from hot water.* The fifth and last process is

27. *The Fixing of the Picture*,—Which is accomplished by removing the sensitive matter from the paper. The picture, or as many of them as there may be, is to be soaked in warm water, but not warmer than may be borne by the finger; this water is to be changed once, or twice, and the pictures are then to be well drained, and either dried altogether, or pressed in clean and dry blotting paper, to prepare them to imbibe a solution of the hyposulphite of soda, which may be made by dissolving an ounce of that salt in a quart (forty ounces) of water.† Having poured a little of the solution into a flat dish, the pictures are to be introduced into it one by one; day-light will not now injure them; let them soak for two, or three, minutes, or even longer, if strongly printed, turning and moving them occasionally. The remaining un-reduced salts of silver are thus thoroughly dissolved, and may now, with the hyposulphite, be entirely removed, by soaking in water, and *pressing* in clean white blotting paper, alternately; but if time can be allowed, soaking in water alone will have the effect in twelve, or twenty-four, hours, according to the thickness of the paper. It is essential to the success of the fixing process, that the paper be, in the first place, thoroughly penetrated by the hyposulphite, and the sensitive matter dissolved; and next, that the hyposulphite compounds be effectually removed. Unless these salts are completely removed, they induce a destructive change upon the picture, they become opaque in the tissue of the paper, and entirely unfit it for the next, which is

28. *The Printing Process*.—The picture being thus fixed, it has merely to be dried and smoothed, when it will undergo no further change. It is, however, a *negative* picture, (§ 4) and if it have cost some trouble to produce it, that trouble ought not to be grudged, considering that you are now possessed of a matrix which is capable of yielding a vast number of beautiful impressions. I have had as many as fifty printed from one, and I have no doubt that as many more might be obtained from it.

29. The manner of obtaining these impressions has been so often described, and there are so many different modes of proceeding, that it may be sufficient to notice very briefly the best process with which I am acquainted. Photography is indebted for it to Mr. Alfred Taylor, the eminent chemist, whose pamphlet on the subject will supply

* I now find that a horizontal jet of *steam* answers better than any thing I have yet tried

† Specific gravity 1014.

every detail. His solution is made by dissolving one part of nitrate of silver in twelve of distilled water, and gradually adding strong liquid ammonia, until the precipitate, at first produced, is at length *just* re-dissolved.

30. Some paper is to be met with containing traces of bleaching chlorides, which does not require any previous preparation; but, in general, it will be found necessary to prepare the paper, by slightly impregnating it with a minute quantity of common salt. This may be done by dipping it in a solution in which the salt can barely be tasted, or of the strength of from thirty to forty grains to a pint of water. The paper, after being pressed in clean blotting paper, has merely to be dried and smoothed, when it will be fit for use.

31. The ammonia-nitrate of silver is applied to the paper in the manner described in § 15, and, when perfectly dry, the negative picture to be copied is to be applied to it, with its face in contact with the sensitive side. The back of the negative picture being uppermost, they are to be pressed into close contact by means of a plate of glass, and, thus secured, they are to be exposed to the light of the sun and sky. The exposed parts of the sensitive paper will speedily change to lilac, slate-blue, deepening towards black, and the light, gradually penetrating through the semi-transparent negative picture, will imprint upon the sensitive paper beneath a *positive* impression. The negative picture, or matrix, being slightly tacked to the sensitive paper by two mere particles of wafer, the progress of the operation may from time to time be observed, and stopped at the moment when the picture is finished.

32. It ought then, as soon as possible, to be soaked in warm water, and fixed in the manner described in § 27.

33. In these pictures there is a curious and beautiful variety in the tints of color they will occasionally assume, varying from a rich golden orange to purple and black. This effect depends, in a great degree upon the paper itself; but it is modified considerably by the strength of the hyposulphite, the length of time exposed to it, by the capacity of the paper to imbibe it, and partly, perhaps, by the nature of the light. Warm sepia-colored pictures may generally be obtained by drying the paper, by pressure, and making it imbibe the hyposulphite supplied in liberal quantity.

The paper of "I. Whatman, Turkey Mill," seems to give pictures of the finest color, and, upon the whole, to answer best for the purpose; and the successors of that gentleman, the Messrs. Hollingsworth, being so obliging as to prepare some paper with a little salt added to the sizing material, it is to be hoped, from its requiring no trouble, or preparation, injurious to its surface, that the demand for it will be such as to induce them in future to manufacture it as an article of commerce.

If the chemical agents employed be pure, the operator, who keeps in view the *intention* of each separate process, and either adopting the manipulation recommended, or improving upon it from his own resources, may rely with confidence upon a satisfactory result.

Lond., Edin. & Dub. Phil. Mag.

Account of Steel-Making at the Fitzalan Steel and File Works, Sheffield.

The “converting furnaces” are the scene of the first stage in steel making. The object in view is to saturate iron bars with carbon to such an extent as to change their quality from iron to steel. The bars so saturated are of various widths, and are partly Swedish, and partly English, according to the purposes to which the steel is to be applied. These bars, when adjusted to convenient lengths, are packed, or piled, up in the converting furnaces in a singular manner. Each converting furnace, viewed outwardly, has somewhat the shape of a glass house, being a sort of conical covering to an oven of very large size. The oven contains two oblong receptacles, or troughs, each measuring nearly twenty feet in length, about a yard deep, and the same in width. They are so placed, with respect to each other, that a strong body of flame may play around both of them, and raise to a high heat whatever may be placed in them.

On the bottom of each trough is placed a layer of coarsely powdered charcoal; then a layer of iron bars, placed side by side, as many as the width will admit; then another layer of charcoal; then a layer of iron bars, and so on till the trough is filled, at which time it contains more than thirty alternations of iron and charcoal. The surface is covered with a clayey substance called *wheelswarf*, derived from the abrasion, or wear, of the numerous grind-stones used at Sheffield, made into a kind of cement, or putty. A fire is kindled with Sheffield coal, (which is found to be excellently adapted for this purpose,) and kept up fiercely for many days. During this time the iron is in a red hot, or, perhaps, a white hot, state; the charcoal is also highly heated, and the iron seems gradually to absorb a portion of charcoal into the very heart of the bar. The coating of wheelswarf prevents the charcoal from burning away, and thereby leaves it in a condition to act upon the iron. One of the bars is so placed in the trough that it can be drawn out occasionally without disturbing the others; and from the inspection of this bar the workman tests the progress of the operation. Steel, for coach-springs, requires less of this action, or a “lower degree of conversion,” and is, therefore, exposed to a lower heat than any other; steel for numerous common articles of manufacture requires a higher conversion; steel which is afterwards to be “sheared,” or hammered, for knife-blades, and other purposes, still higher; steel for files requires a yet higher degree of conversion; and steel, which is afterwards to be cast in a fluid state, requires the highest of all. The business of the steel converter, therefore, is one of some nicety, demanding the exercise of care and judgment.

The bars of iron when removed from the converting furnace, are in that state which procures for them the name of *blister-steel*. They have absorbed only about one per cent. of carbon, yet their quality is greatly changed. The steel in this form, is not regarded as a material for manufactures, except for coarse goods; it is carried to a further stage before it has the necessary compactness and completeness for

use in finer work, since the blisters, even if no other defects existed, would unfit it for all but coarse purposes. It obtains the name of *common steel*, when, after being again heated, it is hammered with a very ponderous hammer, whereby a tougher quality is imparted to it. The most customary process to which it is next subjected, is *shearing*—a name worthy to be classed among those which illustrate the odd nomenclature of manufactures. When we see “shear steel” stamped on table-knives, we may not inaptly imagine that it is steel which has been cut with a pair of shears; but the connexion is more remote. This steel, soon after its introduction, being found suitable for making shears, it obtained the name of *shear-steel*, and by another step in the same road, the process came, at length, to be called *shearing*—a name about as consistent as it would be to apply the term *shoeing* to the process of tanning a calf-skin, on the ground that it makes leather fit for shoes.

The process of shearing steel is somewhat analogous to the welding of iron. It consists in heating several pieces, and hammering them one upon another, until all form one mass, greatly more dense, compact, and tough than the blister steel from which it was made. This department of the manufacture introduces us to a part of the works where some new features of arrangement demand our notice. The *till-house*, or the *shear-house*, is a building constructed with especial reference to strength, and resistance of vibration. On entering this building we see on the left hand furnaces for bringing the pieces of blister steel to a proper heat for welding, or shearing; while before us are three hammers of enormous size, and remarkable construction. The centre one of these hammers is the shear-hammer, employed in the operation now under notice, while the other two are tilt-hammers, for a process which will be noticed further on. Each hammer consists of a mass of iron with a steel face, fixed at the end of a ponderous mass of wood bound with iron hoops; and all these three handles are connected with a revolving shaft, or drum, worked by a steam engine. There is mechanism attached to this end, whereby the huge hammer is worked up and down with great rapidity, much in the same way as hammers are used by hand. So far the arrangements seem clear enough; but it is not until we consider the vibratory and shaking action of a hammer weighing twenty cwt. in rapid motion, that we can rightly understand the necessity for enormous strength in the building. Any ordinary structure would be shaken to pieces under this visitation; and hence a foundation has to be laid to a surprising depth, to prevent this result. In the first place the drum, or revolving shaft, for the three hammers, weighs thirty-six tons, and the bearings for this rest upon a mass of stone work twenty feet deep, formed of ten cubical stones weighing seven tons each. Then, as the anvil, or flat mass, of steel on which the blows of each hammer fall, must bear up against this immense concussion, it is placed on a mass of stone weighing seven tons, and this again is supported by a tree, or a trunk, of timber thrust upright many yards deep in the ground, and bound round with iron hoops. Altogether, therefore,

there is a vast deal of underground work to fit this tilt-house for the purposes to which it is applied.

In this building, then, the steel is sheared and tilted. The bars of blister steel are broken up into pieces about a foot long. These are heated in a furnace, or forge, and when at a white heat they are brought under the operation of the large tilt-hammer, by which they are beaten out to thirty inches in length. To change these pieces into shear-steel, half a dozen of them are put one upon another in a pile, and fixed firmly at one end in a groove, or long handle. The group thus connected is placed in a furnace to "soak," according to a technical phrase, that is, to be partially heated, preparatory to a more intense heating. The group is taken out of this first furnace, and transferred to another, where a fierce fire brings it to a white heat. The workman attends carefully to the state of the steel while in the furnace, as great nicety is required in the degree and equalization of the heat attained. When sufficiently heated, the group (still held by the handle) is taken out of the fire, and placed under the largest, or shear, hammer, where it is beaten on all four sides until all the pieces become thoroughly amalgamated, or welded, one to another, and the result appears in the form of a bar of steel two or three inches square. Each hammer has a kind of blast-pipe, to blow dust and dirt from the anvil beneath. In some cases the bar is cut in two, heated again, and again welded, whereby the process is carried still further. According to the degree to which it is welded, or sheared, the steel is called "double shear," "single shear," or "half shear." During the heating, preparatory to the hammering, the group of pieces requires a degree of attention whereby the workman is exposed to a very intense heat.

The shear-steel, made by this process, when closely examined, is found to have lost all the flaws and blisters which distinguished it as blister-steel, to have acquired a uniformity of character throughout, and to be greatly more malleable and tenacious than it was before.

There is, however, yet to be described a kind of steel more important than either of those hitherto described, and one to which the beauty of modern steel goods, is, in great part, indebted; we allude to *cast-steel*. As the heat employed in melting steel is the greatest which the manufacturing arts of any country exhibit, the furnaces, the crucibles, and all the apparatus employed, must be so formed as to endure this heat; and we must, therefore, notice these appliances before we can understand the process itself.

The crucibles, or melting pots, are rather less than two feet in height, and have a somewhat sugar-loaf shape. They are made of Stourbridge clay, wrought to the greatest possible degree of uniformity, and smoothness. To give this uniformity, the clay, after being mixed with water, and well worked up, is spread out in a thin layer on the floor of a room under the casting-house. Two men, with naked feet, tread, or trample, on the clay, uninterruptedly, for five, or six, hours, walking, or jumping, or dancing, or shuffling, (for it is hard to know which to call it,) over and over again, from side to side, and from end to end, until every particle of clay has been trodden repeatedly. It might seem strange why some kind of mill should not be employed

in this operation; but those who are most likely to understand the matter, state that no other method equals this for bringing the clay to a perfect uniformity of substance, and expelling all air-bubbles. When the clay is prepared, it is made into crucibles weighing about twenty six pounds each, by fashioning it in a mould having a core to give the internal form. The crucibles, as they are made, are placed in a vault where both air and warmth can come to them; and, when dried by this means, they are placed, on the night before they are to be used, on an annealing grate, where they are covered with cinders, and allowed to remain till the next day. These operations of crucible-making are continued uninterruptedly, for, notwithstanding the care and trouble bestowed, each crucible will only last one day.

The cast-house consists of two rooms, or compartments, both paved with stone, and each containing six melting furnaces. These furnaces are very different from others which we have had to mention; for they exhibit to the eye nothing but a hole in the floor about 18 inches square. There are six of these holes in a row in each shop, and so long as they are covered by iron covers, or lids, there is nothing particular to be seen; but when one of these lids is removed, a fearfully intense heat is shot upwards from beneath. Each hole is the mouth of a furnace, and each furnace is a cell measuring about four feet deep by eighteen inches square, being merely large enough to contain two crucibles with the requisite quantity of fuel. There is a grate beneath, through which a powerful draught ascends to the fuel; and there is a flue at one end to carry off the smoke and heated gases. Neither bellows nor blast-engine is used; the intense heat being wholly excited and maintained by the judicious admission of air from a vaulted chamber beneath. The walls of these small furnaces are exposed to such a destructive temperature, that the selection of the material, with which they are lined, becomes a matter of much importance. This material obtains the name of *ganister*. It is a kind of stone found near Sheffield, and is used, in the first instance, as road-metal, after which, when ground to dust by wheels and horses' feet, it is collected and made into a plaster, or lining, for the furnaces.

Let us now see what passes in one of these cast-houses. Each crucible-full of metal requires about four hours to effect its perfect fusion; and there are three successive meltings in twelve hours. Each furnace is supplied with coke to a certain height, and the two pots, or crucibles, are adjusted within it, side by side. More coke is then thrown in, until both pots are entirely surrounded by it. Here they are left to be acted upon by the fire, until they are brought to a dazzling white heat. The cover of the furnace is opened, and a long funnel made of sheet-iron is let down into each pot, having its open end at a convenient height above. The steel, broken up into small fragments, and amounting to thirty, or forty, pounds for each pot, is thrown into the funnel, and allowed to fall down into the pot. The funnel is then removed, the cover put upon the pot, coke added so as to enclose it completely, and the lid of the furnace put on. From time to time, during the ensuing period of four hours, the lid is removed; and the progress of the melting watched, more and more coke

being added when necessary, so that ultimately there are from four to five tons of coke used in melting one ton of steel.

As the time approaches for the casting, the men make preparations which sufficiently indicate the sort of "fire-king" ordeal to which they are about to be exposed. They cover their legs and body with coarse sacking, or leather, saturated with water from a trough at hand, and prepare to fill the ingot-moulds with the melted steel. These moulds are formed of metal, so shaped as to give oblong bars, or ingots, weighing from thirty-six pounds to two hundred pounds each, according to circumstances. Each mould is divided into two halves, which halves are bound closely together when the casting is about to take place. The mould is first coated on the inside with a kind of oily composition, closed up tightly, and placed vertically in a hole in the stone floor of the cast-house, with the upper end open. One of the men draws off the lid of a furnace, and the white-hot coke is removed from about the pot which is about to be emptied. A man then takes a long instrument acting like pincers, or tongs, hovers over the furnace in a manner which is almost fearful for a spectator to witness, puts the tongs down into the furnace, grasps one of the pots firmly, and draws it up; having, during this time, his face directly over a furnace, so intensely heated, as to convert steel into a liquid, and drawing up, in this hazardous position, a white-hot crucible weighing, with its contents, sixty pounds. He rests the glowing mass with its lower end on the floor; another man strikes off some of the adhering slag with a long iron bar; a third man grasps the crucible with an instrument held horizontally; the first man loosens his hold, and, with his tongs, takes off the cover of the crucible; the third man lifts up the mass, (no trifling weight when held horizontally at the end of a bar,) goes to the ingot-mould, and pours the liquid steel into it; while a fourth man, standing before him, clears the liquid stream from any impurities as it flows, by means of a long rod. Thus all four have their prescribed office, and no description can give an adequate idea of the scene which is presented. The terrible yawning mouth over which the first man hovers, the glowing mass which he draws forth, the intense whiteness of the liquid steel as it flows into the mould, the profusion of delicate greenish sparks which shoot forth during the pouring—all form a spectacle, which, when once seen, will not be soon forgotten.

The part of this operation which exposes the workman to the greatest heat, is that of drawing the pot from the furnace; but the part requiring most skill is that of "teeming," or pouring, into the mould, since it is necessary that the liquid stream should fall directly down the centre of the mould, without striking against the sides more than can be avoided. The eyes of the men are weakened by the intense glare to which they are exposed, but it does not appear that the general health suffers in any marked degree; yet a stranger may well marvel how any human frame could bear such a trial for years together.

Immediately after each pot is emptied, it is returned again to the furnace, again brought to a white heat, again filled with pieces of

steel, and again exposed to four hours' heating. After this has occurred three times, or one entire day, the melting-pot has rendered its services, and is then cast aside to be replaced by another. With regard to the steel thus melted, certain important changes have taken place within the last few years. It has often been conjectured that the Swedish iron derives some of its valuable properties from the presence of a small quantity of manganese; and within the last few years manganese has been introduced as a material to be added to the bar-steel in the melting-pot, in order to impart to the cast-steel certain valuable qualities which it did not possess before this improvement was introduced—such as a facility for being worked up into certain articles of cutlery. The history of the invention is rather complicated, and involves some of those unpleasant features of which our patent laws exhibit too many examples. The invention was, we believe, placed in a practical form, and patented by a Mr. Heath, but through certain technical flaws in the specification, the method has become thrown open to all; Sheffield has been greatly benefited, but the inventor has not. There is now a large quantity of carburet of manganese used weekly by the steel-melters of Sheffield; and the use of cast-steel for table-knives, and other articles of cutlery, has been one of the results of the invention. The matter is not one for discussion here, but it seems a pity that an invention which benefits a whole town should not benefit the inventor.

If the cast-steel is for the purpose of making saws, the ingots are rather flat, so as to be conveniently rolled into sheets at the rolling-mill; but if for other purposes, they are generally about as thick as they are wide. The rolling of steel into sheets, or into bars, is so precisely analogous to that observable in the iron manufacture, that the same description suffices for both. The rolls are very ponderous, weighing as much as five hundred pounds each; and when they are about to be used, the steel, whether "shear," or "cast," is heated in an adjoining furnace, and passed repeatedly between the rolls while yet red hot, by which it assumes the form either of bars of any require shape, or of sheets.

The *tilting* of steel is another curious process, the object of which is to close the pores of the steel, and to render it as dense and compact as possible. All steel for the best articles is tilted before being applied to use, whether it be "shear," or "cast." The tilting is one of the operations carried on in the building described in a former paragraph as being constructed with such great strength. There are two swings, or suspended cradles, in the tilt-house, one near each tilt-hammer. In these swings the men sit while holding the bars of steel to be tilted; since they can move their bodies to and fro (to bring every part of each bar under the operation of the hammer,) more easily when they thus sit, paddling along with their feet, than if they stood, or walked. The bars of steel are heated to a certain temperature in an adjoining furnace, and are then brought under the action of the tilt-hammer, where a deafening clatter is kept up for some minutes, accompanied by a vibration all around, which would shake to pieces any but a building of great strength.

It is one of the peculiarities of Sheffield, that tilting is a trade by itself. In a map of the town we may see marked Mr. So-and-so's "*Tilt*," for, with the usual brevity of technical language, the whole building, with its hammers and furnaces, is called a tilt. These tilts are mostly situated on the banks of some one, or other, of the rivers which flow through Sheffield, and it is impossible to mistake them when once in their neighborhood. There is one, for instance, close to the Lady Bridge, where, from morning till night, there is an incessant thumping, which shakes the very roadway itself. These tilters, or proprietors of tilt-works, receive steel in the form of bars, from any parties, and pass it under the tilt-hammers, after which their occupation is ended.

Lond. Penny Mag.

Account of the Introduction of the Manufacture of Porcelain in France, by Bernard Palissy.

Palissy was born in some village, the name of which is unknown, in the diocese of Agen, about the year 1500; he followed the humble calling of a land surveyor, to which, as he advanced in years, he added that of painting on glass.

At that period the art of porcelain-making was unknown. The discovery of Herculaneum and Pompeii have enabled us to determine the progress made by the ancients in the arts of pottery; and in the beginning of the sixteenth century, the only manufactory of crockery which could pretend to the name of porcelain, was at Faenza, in Italy, whither it is said to have been transported from China, by certain Venetian merchants. From this manufactory was derived the name of *faiënce*, or *faïence*, still used in France.

It happened that, in a visit to Agen, Palissy, the painter on glass, obtained a sight of a specimen of faenza, or of Oriental porcelain, which inspired him with the hope of discovering some sort of white enamel, by which earthen-ware might be encrusted; and from that moment he devoted fifteen years of his life to the pursuit of this single object. It appears a simple method to have proceeded at once to Faenza, and become a workman in the famous pottery. But means for so long a journey, were, probably, wanting to the poor village geometer, and he accordingly gave to the enterprize all that was in his *power*, every moment of his days, and every faculty of his mind.

As a painter on glass, the art of mixing and fixing colors was well known to him; but the difficulty of transferring these to pottery-ware, and covering them by a transparent silicious varnish, seems to have baffled his most persevering endeavors. Scarcely able to provide for the maintenance of his wife and family, he had the greatest difficulty in procuring colors and pottery to effect his experiments. Half his time was lost in grinding and pounding materials, and the vain attempt to construct the necessary ovens: at length he contrived to interest the owner of a pottery, who undertook to bake for him his experimental pieces; but partly from ignorance, partly from ill-will, the attempt was inexpertly made, and, ruined in fortune, health, and spirits, at the close of twelve years of incessant labor, Palissy was

compelled, by the wants of his family, to abandon his pursuit, and resume his more thriving calling as an engineer. Having obtained from the district a commission for the draining of certain salt marshes, he executed his task with credit and profit. No sooner, however, had he obtained the means of continuing his attempts, than he returned with greater diligence than ever to his enameling, and despatched the new samples of his skill to be baked in the furnace of a glass-house.

And now, for the first time, the composition he had invented proved fusible. Out of *three hundred* specimens of various experiments submitted, at the same time, to the action of the furnace, a single one presented, on cooling, a hard, white, vitreous, brilliant surface; and the joy of poor Palissy, in the discovery, may be easily conceived.

"I was, however, at that time of my life so simple," says he, in his narrative of his experiments, "that the moment I had hit upon the real enamel, I set about making the pottery-ware to which it was to be applied; and, after losing eight months in the task, I had next to construct a furnace similar to those of the glass-houses, in which it was to be baked. No one can conceive the trouble it cost me, for I had to do all by the single labor of my hands—to sift the mortar, and even to draw the water with which it was to be mixed. I had not so much as the help of a single man in fetching the bricks: my own back bore all!

"My first baking prospered pretty well; but when it came to the second, after the enamel had been spread over the pottery, I was unable to produce the heat necessary for the fusion. Six days and nights did I remain feeding and watching the furnace, half distracted, and almost stupefied by the intense heat, and my own bitter disappointment. At last it occurred to me that the composition contained an insufficient proportion of the substance which had produced fusion in the former instance; and I accordingly set about grinding and pounding, though still obliged to keep up the fire of the oven, so that I had treble labor on my hands.

"The former pieces being now spoiled, I was forced to go out and purchase new pots to be covered by the fresh composition; and, on my return, I had the misery of discovering that my stock of wood was exhausted! What was to be done? I rushed into my garden, and tore up the trellises; and these being insufficient, was obliged to sacrifice the dressers, stools, tables, and boarding of my house! All these were successively thrust into the furnace, in the hope of melting the enamel!"

The reader will probably recall to mind the account given by Benvenuto Cellini, in his memoirs, of having contributed all his pewter dishes and household utensils to the metal prepared for his noble statue of Perseus, which proved slow and difficult of fusion. But the Italian protégé of princes makes a vaunt of *his* sacrifice, whereas the meek Palissy couches his statement in the terms of a confession.

"Scorched by the heat of the furnace," says he, "and reduced to a skeleton by the transpiration arising from this prodigious heat, I had now a new vexation in store for me. My family having indiscreetly

circulated the report of my taking up and burning the flooring of my house, I was considered insane by my neighbors, and my precarious credit totally destroyed. If I had then died, I should have left behind me the name of a madman who had ruined his family by a frantic speculation. But though sick and dispirited, I cheered myself with the certainty that the discovery of which I had been so long in pursuit was effected; and that henceforward I had only to persevere in my labors. The difficulty of maintaining my family for five, or six, months longer, till a satisfactory result could be obtained, was the first consideration; but in order to hasten the period, I hired a potter to assist me in my work, furnishing him with models and materials.

"A cruel drawback it was, that I was unable to maintain this man in my dismantled home, for I was forced to run up a bill for his board at a neighboring tavern. Nay, when, at the end of six months, he had made me the various articles of crockery according to my designs, so that nothing remained to be done but to cover them with my enamel, and submit them to the furnace; being forced to dismiss my workman, I had no means of paying him his wages, except by giving him my clothes, which I accordingly did; and my person was now as thoroughly dismantled as my house!"

All the rest of his labors, poor Palissy had to encounter alone, though his hands were so cut and bruised with his work, that he was obliged, he says, to eat his pottage as well as he could with his hands wrapped in linen rags. The hand-mill, in which he ground his materials, required the power of two strong men to work it, yet he was wholly without assistance. Nor were his disappointments yet at an end. After having, with infinite pains and considerable cost, constructed a new oven, it turned out that the mortar he had used was full of flints, probably the refuse of his materials; and when the furnace was heated, these flints flew, and attached themselves to his pottery, so that it was completely spoiled.

"On passing the hand over my vases," says he, "little fragments of flint were perceptible, which cut like a razor. I instantly determined to break them up, rather than sell them in a deteriorated state for what they would fetch, which might have injured the reputation of my discovery. But no sooner had I done so, than I was beset by the maledictions of my starving family, and the mockery of my neighbors, who treated me as a madman for not having realized a few crowns by my damaged goods."

Nevertheless the man of genius toiled resolutely on!—Satisfied of the strength that was in him, and of the importance of his discovery, he went to work again, with an injured credit and constitution, an object of hatred to some, and contempt to others. From the exhausting nature of his labors, his arms and legs had become like sticks, so that, according to his own brief description, there was nothing to keep up his garters, and his stockings came upon his heels as he walked, till he was the picture of wretchedness and destitution. Between the action of the prodigious heat of his furnace, and the influence of the rain and frost on his ill-constructed works, the place was frequently unroofed, compelling him to borrow the materials for its reparation.

But this was not always to be accomplished; and he tells us that he often remained watching his oven through the winter nights, exposed to wind and weather, with the owls hooting on one side, and the dogs howling on the other.

“Wet to the skin with the beating in of the heavy rains, and groping about in the dark, for want of a candle, I have often retired to rest at midnight, or even at day-break,” says he, “looking like some drunken wretch who had been rolling in a gutter. But the worst I had to suffer was from the accusations of my neighbors, who had assisted me, and who now regarded me as a robber; and the reproaches of my family, who treated me as a selfish lunatic.”

This is but a faint outline of the miseries and fatigues sustained by poor Bernard Palissy, in bringing to perfection an art which has proved so highly beneficial to his own and other countries. The furnaces and ovens of his invention are still in use at Sèvres, and have been closely copied in our own and other porcelain works. The moulds in which the vases are baked to secure them from accident, were devised by Palissy, after his unlucky loss from the flying of the flints; and his recipes for the mixing of colors are still patent.

The porcelain of Palissy soon attained a prodigious reputation, and few museums, or collections of objects, of *virtù*, in our own time, but contain specimens of his works, under the name of Raphael-ware, or china of the middle ages. The embossed dishes exhibiting reptiles and animals, in great perfection, were the invention of Palissy; and several of his dishes and vases present copies after celebrated pictures, executed in relief. Table services, to replace the wooden and pewter vessels then in use, were the chief objects to which he devoted his art; and with so much taste and skill, that many of the original designs exhibit the genius of a first-rate sculptor.

The fame of his discovery extended rapidly through France, and orders were given him by all the nobles of the court of Henri II; among others, by the Duc de Montmorency, who employed him to decorate his stately château of Ecouin. One of the chambers was paved with tiles of Palissy's porcelain, which still remain perfect, unless where the design has been destroyed by the introduction of one of those huge ungraceful N's, which, during the empire, were made to disfigure all the ancient public edifices of France.

Ibid.

Mr. Bain's Electric Printing Telegraph.

The dispute between Professor Wheatstone and Mr. Bain, as to the legal and moral standing of each in the matter of electro-telegraphs, and electro-clocks, has already been noticed by us at some length. We have no intention of alluding to that dispute further, on the present occasion, than to remark that it has not deterred Mr. Bain from pursuing the subject. Having completed a telegraphic apparatus, he has profited by the liberality of the directors of the South Western Railway Company, to fix it on their line, and to exhibit it

at the Nine Elms Station, to a great number of gentlemen interested in railways, and in the progress of science. The apparatus transmits signals to and from Wimbledon, a distance of *six miles*; its action, while we witnessed it, was extremely rapid, and very certain; every message (indicated by numbers,) was transmitted and returned correctly, the process of printing it going on in the meanwhile.

This important invention has some peculiarities which require to be separately noticed, before a correct idea of their joint effect can be obtained. 1st, it is now well known that if a metallic communication be made in one direction, between the distant parts of an electrical apparatus, water, or the moist earth, will serve safely for that in the other, or returning direction. Some part of the dispute before mentioned, referred to the priority of the discovery, or application, of this fact; and it turned out that neither of the present disputants was really the first who had observed it, although Mr. Bain certainly had re-discovered it. But the latter named gentleman has made another, and more important advance. In the former case the earth was merely found to be a safe medium for *transmitting* the electric fluid. He has now found that a considerable length of moist soil may be made to *generate* electricity enough to work a telegraph, by merely burying in the ground, or immersing in water, at two distant points, a sufficient surface of positive and negative metals, and connecting them by an insulated wire. In this manner is obtained the electrical power which controls Mr. Bain's telegraph. A copper plate being placed in water at London, and a corresponding zinc one at Wimbledon, the two being connected by a single copper wire, the artificial galvanic battery is entirely dispensed with. We may here add that Mr. Bain has found, that the greater the length of moist soil comprehended between the metallic surface, the more intense is the electric current obtained, although it is of less quantity. He finds also that this terrestrial electricity is very constant in its intensity. It is found that the telegraph can be worked with metal plates of only 4 square inches each, making 8 square inches of surface in each. The plates actually employed are each of one foot square.

Secondly, electro-telegraphs have chiefly hitherto been immediately actuated by the deflecting power of the galvanic current. If a needle, which freely vibrates on a centre, is placed in the middle of a coil formed of many convolutions of insulated wire, in such a manner as that it is parallel with the plane of the coil, and can vibrate freely, and if an electric current be directed along the wire, the needle will be deflected from its original position, and this deflection will take place to the right hand, or the left, just as the current may pass, in one direction, or the other, along the wire. A variety of contrivances have been employed for indicating, by the motion and direction thus given, to several needles, the message intended to be transmitted by the electric telegraph. The indication depended on the deflection of the needle by the immediate action of the galvanic force. In some, however, a weight was employed to move the machine, and the motion, thus obtained, was interrupted by bringing into action the parts of an electro-magnetic apparatus at the distant end, by means of

wires connected with a corresponding apparatus at the end from which the signal was made. In Mr. Bain's new telegraph the machine is actuated by weights, but its motion is stopped by a detent, until interruption of the galvanic current is made to release it at the pleasure of the operator at the other station. The acting power is here not in the electric current, but in the weight, and the current is required to be only of the trifling energy necessary to move the controlling detent under very small pressure.

Each telegraphic system on Mr. Bain's plan consists of the plates and single wire already described, and of two machines, exactly alike, one at each of the two stations, between which the communication is to be made. The machines themselves form part of the metallic connexion between the plates. So long as the electric current flows without interruption, the machinery is quiescent, being locked by the detent; but the instant the connexion is broken, the detent makes a slight rotation, by which the clock work is disengaged, and the signaling commences. It is preferred, and with good reason, we think, to make the rest of the machinery—not its motion—depend on the continuance of the connexion, since any failure of the electrical apparatus is then instantly brought to notice by its putting the machine in action.

The electro-magnetic apparatus, which is employed solely to actuate the detent, is constructed as follows:—A light vertical spindle carries a brass bar, on each extremity of which is fixed, by the middle of its length, a semi-circular magnet, the ends of the two magnets nearly touching each other, and the magnets themselves nearly completing a circle, of which the spindle is the centre. Two insulated wooden bobbins, affixed to the frame of the machine, are bored out large enough, longitudinally, to admit the magnets to pass through them without touching, and they carry the coils of wire which form part of the electric route. They are placed longitudinally to the magnets, and so that the ends of the latter meet within their central cavities. When the electric current is made to pass along these coils, the magnets, with their spindle, are made to rotate through a small arc in one direction; as soon as the current is interrupted, the power of these coils ceases, and a constant magnet, placed at a little distance, brings back the electro-magnets, and their spindles, to their original position. A protuberance on that spindle fulfils the office of detent, being cut on one side nearly to its centre; the extremity of a long light arm, which is carried by one of the last arbors of the clock-work, and, therefore, revolves rapidly, rests on this protuberance when it is in one position, and passes by its flat side when in the other.

Each machine consists of three parts, that which gives motion to a hand like that of a clock; that which, on the pointing out of a telegraphed figure, strikes a bell; and that which prints the figure. Supposing now the machine to be set agoing, by having made the necessary electrical disposition for releasing the detent, we observe, first, that the hand rotates in front of a dial, its point passing by the nine digits, a cipher, a large dot, a vacant space, and its starting place, arranged in a circle; next we see, that, on the hand being stopped at

any figure, by breaking the electrical connexion, its part of the machine stops, the striking part begins to go, and soon strikes a spring bell, and the printing apparatus acts so as to leave an impression of the figure, at which the machine was arrested, on a piece of paper wound round a revolving cylinder on the left of the machine. This is repeated for any figure, or any number of them, which may have been desired. When the communication is closed, the same is done with the dot, or period. After waiting, perhaps, half a minute, the machine begins to go again, apparently of its own accord, but really by the action of the assistant at Wimbledon, and the same figures are repeated by the hand stopping at each of them, and printing it, and sounding the bell also as before. The same interruption of the electric current, which stops the machine at one station, stops also at the same instant that at the other; and as the hands of the two machines are originally set together, and afterwards revolved at the same speed, it is obvious that the figure at which one is stopped, will be pointed out at the same instant by the other. The printing is effected by types projecting radially from the periphery of a wheel. The types are so disposed on the periphery, and the wheel is so geared to the machinery which carries the hand, that when a given figure is pointed out on the dial, the same is presented by the wheel to the paper. The type wheel is pressed forward to imprint the figure on the paper.

The two machines, we have said, are exactly alike. The velocity of their rotation is regulated by small governors, like those used in steam engines, and it is necessary that the machines should pretty exactly agree in this respect. If, however, any error of this, or any other, kind should occur, so that the two machines do not point to the same figure at the same time, it is instantly discovered by the following contrivance: The machine, if left to itself, would stop at any one of the figures, or spaces; it goes only so long as the attendant keeps in due order the requisite metallic circuit. But to this there is one exception, that of the vacant space which we spoke of as forming part of the circle in which the figures are disposed; here the machine would not stop of itself. Now if the two machines arrive at this space at the same time, they will both pass over it without stopping; but if one of them points to this space, while the other points to a figure, a stop will there take place, by virtue of the action of the latter machine, and the attendant at the other then instantly perceives, by the improper stoppage on the vacant space, that the instruments do not agree. It is obviously easy to ascertain what is the figure to which the hand of each machine should point, to correspond with the other, since it will readily be seen what figure the hand of one machine passes over without spontaneously stopping, when left to itself.

This novel and highly ingenious telegraph seemed to us to act with perfect correctness in its construction, and the methods devised for its use. Most effectual precautions seem to have been taken against the undetected continuance of error. We understand that a telegraph of this kind has been at work satisfactorily for the last eighteen months. The importance of the physical discovery, on which its peculiar action depends, will not be disputed; and the invention, both in its effect,

and its details, will necessarily command the attention of the railway world. It is remarkable for simplicity; this, however, distinguishes not so much the mechanical parts, which are always in sight, and subject to ready comprehension, and easy repair, as the electrical connexion; here a single wire suffices, and a failure, if it were to happen, would be known to belong to that one wire, precluding the delay, vexation, and uncertainty which are occasioned by a like misfortune to one of the many wires required by other electrical telegraphs. Its comparative cheapness, and its facility of management, are important recommendations; but a still greater, we think, is the uniformity of its action, depending, as it does, not on batteries, whose power is constantly varying, but on the electricity of the earth itself. We congratulate Mr. Bain on this successful exhibition of the results of his long-continued labors, and we earnestly trust that neither pirates nor professors will again annoy him.

Lond. Mechanics' Mag.

Remarks on Parsons' Locomotive Expansive Apparatus.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sirs,—The March number of the Journal of the Franklin Institute contains a description of "Parsons' Locomotive Expansive Apparatus." That part of the arrangement which provides an adjustable cut-off, by the use of two slide-valves attached to the same rod, one by right handed, the other by left handed, screws, and the mode, adjustment, &c., are precisely those for which I obtained letters patent in August, 1841. The *American Repertory*, for December, 1841, contained a part of my specification and claim.

The patent of Mr. Parsons is dated December, 1842, and was enrolled in June, 1843.

The "adjustable cut-off," as my invention is named, has been adopted on an engine lately put to work on the railroad from Jersey City to New Brunswick, to one on the Long Island road, and to engines building for the Patterson road, and for the Stonington road.

I intend soon to send you accounts of the performance of these engines, which have been very satisfactory, and shall also furnish a full description of the combinations embraced in my patent.

Yours respectfully,

HORATIO ALLEN.

New York, May 14, 1844.

Metallic Sand.

At the meeting of the Society of Arts, of the 29th of January, 1843, the secretary read a paper by Mr. H. K. Dyer, on the metallic sand. This sand is produced by grinding copper slag by means of powerful machinery, and consists of iron, zinc, arsenic, and silica, the iron predominating: the slag is procured in abundance in Swansea. In chemical analysis it is very similar to the pozzolano, and in point of durability is found to be equal to the latter. With blue lias lime,

which is used for hydraulic works, the metallic sand readily enters into combination, and these having been used together for external works, exposed to all the changes of the atmosphere, have proved the indurating qualities of the metallic sand, after an experience of eight years. The metallic sand contains a greater proportion of iron than *pozzolano*, or any other material yet introduced to the public, and hence the indurating property which it possesses; and its granular form, and sharpness of its angles, must also be admitted as an additional reason for its extraordinary tenacity. As a concrete, it was mentioned that the metallic sand had been successfully employed in the entire foundations of the new Houses of Parliament, and was used by the Metropolitan Wood Paving Company, in forming the sub-stratum on which their blocks were laid, and who were so convinced of its efficiency, that they secured from the patentees the exclusive privilege of using it for such a purpose; and to the unyielding nature of their foundations may be attributed, in a great degree, the successful results which have attended the work executed by that company. As a mortar, it was admirably adapted for tunnels, sewers, sea and river walls, and inverted arches, as being impervious to damp, and increasing in hardness from atmospheric influences. In fresco-painting—a matter which is, at this moment, exciting so much attention for decoration in the new houses of parliament—it has been found highly valuable as a stucco for the walls; the combination of the colors with the material imparting an almost endless durability to the work, and the face of the painting might be left in the usual manner, or brought to the highest polish. The process of fresco-painting in Munich, adopted by Professor Hess, it was stated, had been inspected by Mr. W. B. Simpson, a decorator in London, and, in his opinion, the metallic sand cement was equal, if not superior, to any substance with which he had met, from its extreme density and hardness, and its effectual resistance to the entrance of any moisture. Specimens were laid on the table: 1st, brick work of a fresh water tank, which had been erected six years, was removed by a pick-axe; the bricks yielding to the strokes of the axe, but the cement remaining solid; 2nd, imitations of marble executed by a painter on the face of stuccoed work, formed of metallic cement, in conjunction with common chalk, lime, and putty, and afterwards polished; 3rd, a specimen of fresco-painting, also executed on a face similar to the above; 4th, a vase, the figures on which retain their original sharpness, although it has been exposed to the atmosphere for many years.

Glasgow Mech. & Eng. Mag.

*Deposit of Gold recently discovered in the Ural.**

The mass of gold recently discovered in the Ural, is the largest known in the whole world. It was found in the gold bearing sands of Miask, in the district of Zlatoust, not far from the celebrated mines

* This article is an extract of a letter from M. de Kokcharoff, officer of the Royal Mining Company, to M. de Humboldt.—Translated from the *Annales des Mines*.

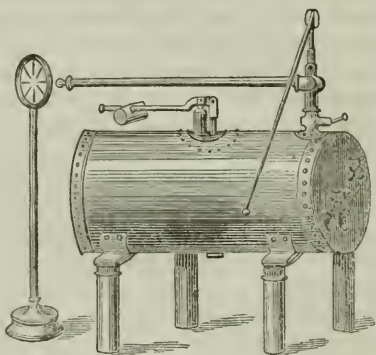
of Tzarevo Nikolæfsk, and of Tzarevo Alexandrofsk, in the southern Ural. These two mines, which you have visited with so much interest, have already yielded, as you are aware, nearly 400 pouds of gold, (6552 kilog.) equal to about 17,544.5 lbs.,—and, more than once, very remarkable masses have been collected there; thus, in 1825, they found there the specimen weighing 24 phounds 68 zolotniks, (10 kilog. 118) about 27.017 lbs. However, these mines beginning to be exhausted, they were compelled to make explorations near the course of the river Tachkou-Targanka, which soon led to the discovery of a bed of gold-bearing sands, of very great richness, but within very narrow limits. This bed once found, they turned off the stream, which had served for washing the sands, up the whole length of this river, and commenced their examinations in the dry bed of the stream. Their success was complete; they came at once upon a stratum of gold-bearing sands, of considerable extent, where the yield of gold was 100 pouds to 8 zolotniks, (a very great proportion, when it is remembered that sands giving 100 pouds to $1\frac{1}{2}$ zolotniks have been before considered well worth exploring;) then other beds were discovered, of a yet greater capacity, which terminated in the examination of the whole valley of the Tachkou-Targanka, with the exception of the spot occupied by the buildings necessary for the washings. In the course of 1842, they pushed the works under the foundations of the building; the first attempts were not successful, but they soon came upon a spot of marvellous richness, where the yield was from 50 to 70 zolotniks of gold in one pond of sand; its extent, however, was very limited. At last, on the 26th of October, 1842, they found this monstrous mass, weighing 2 pouds 7 phounds 92 zolotniks, (36 kil. .020758) 100.078 lbs. It lay upon the strata of diorite, (a variety of trap) in the bed of gold sand, at the depth of $4\frac{1}{2}$ archines from the surface, and under the corner of the building. The mass in question has already reached St. Petersburg, and is placed at the museum of the Institute of Mining Engineers. A discovery which is equally worthy of our attention, is that of a bed of gold-bearing sands on the left bank of the same river before the dike, containing a considerable number of masses; already they have taken thence 52, weighing each from 1 lb. to 7 lbs. Russian.

Note by M. Humboldt.—The largest piece of platina found, up to this time, at Nijni Tageulsg weighs 20 lbs., (Russian) 34 zolotniks. Piece of gold found at Miask, 10 kil. .119=27.0021 lbs. Piece of gold found in the United States, Anson county, N. C., 21.70 kil. = 57.939 lbs. Piece found at Rio Hayna, (1502) and lost in the depths of the sea, (see my critical examination of the geography of the new continent,) 14.500 kil.=38.715 lbs. Wonderful mass of miask found 1842, 36.020 kil.=100.077 lbs.

According to a letter from Count Cancrine, Dec. 3, 1842, Siberia, to the east of the Ural, produced, in 1842, the quantity of 479 pouds of gold=7.846 kil.=21,058 lbs., and the whole of Russia about 970 pouds =15.889 kil.=42,323.63 lbs.

Portable Hydro-Electric Machines. By CHARLES V. WALKER, Esq.,
Editor of the "Electrical Magazine."

There are several forms which have been given to the portable hydro-electric machines. The first to which we may allude is one constructed by Watson & Lambert, for Mr. Addams, the action of which was exhibited last summer, before the members of the United Service Institution; and the power of which we have ourselves had the opportunity of testing with Mr. Addams. It consists of a cylindrical boiler 30 ins. by 16 ins. Five tubes, in a lower row of three, and an upper row of four, traverse the boiler longitudinally. The boiler rests on a frame supported by four glass pillars. Before being placed in the frame, the steam is "got up," by means of an open furnace of a suitable shape; the steam is then "kept up" by a succession of iron heaters, each 15 inches long, which are thrust into the tubes last alluded to; the heaters being prepared in the furnace, after it is vacated by the boiler. A convex cover, applied to each end of the boiler, after the heaters are in, gives the requisite rounded form. One end of the boiler is furnished with a gauge water-cock, and a steam-cock. The boiler also possesses a safety-valve, which is adjusted as high as 90 lbs. Above the boiler rises a short tube furnished with a stop-cock; it enters an inverted hemispherical metal vessel, in which the requisite condensation occurs; from this the hydrated steam escapes through a tube, furnished with the usual box-wood jet. Mr. Addams obtains the electricity of the steam itself, by allowing it to blow through an insulated hollow metal cylinder, furnished within with wire gauze, or metal, points. The spark from the boiler is 10, or 12, inches long.



Mr. Gassiot has a small machine, made under his direction, of a metal globe of the capacity of two gallons; a globe, which was a gas holder, in the days of portable gas, and which can, therefore, bear a high pressure. The steam-tube rises from the top, and curves off at right angles; the jets are fitted up in the usual way. The globe is placed on a small metal tripod, beneath which is a chafing-dish containing charcoal; the whole stands on a square tile, supported by four glass pillars. When in good action, and by careful management, an attenuated spark of an inch may be obtained. Mr. Gassiot exhibited this instrument, and Dr. Pereira exhibited another, constructed after the same model, at the Soirée of the London Institution, held on January 17th last.

The prefixed engraving represents an elegant machine by Messrs. Watkins & Hill, the general construction of which corresponds with

that of the one we first described. The rod, resting on the front of the machine, is a means for conveying the electricity to any piece of apparatus. The circle of converging points, for de-electrizing the steam, was adopted at our suggestion, in place of a mere fork. This machine will charge 70 feet of coated surface in a minute, with 20 grs. on the balance discharger.

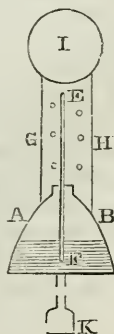
We learn from Mr. Armstrong that very great improvements are continuing to be made in the construction of these machines. He speaks of one "capable of charging 110 square feet of coated surface in a minute, to 20 grs. of Cuthbertson's electrometer, and yet it only discharges as much steam as three of the jets belonging to the great machine of the Polytechnic." The great improvements appear to consist in having been able more duly to adjust the degree of condensation to the size of the jets. More suitable specimens of partridge-wood have also been obtained. Mr. Armstrong also mentions that the manufacturers are endeavoring to make some which shall be heated by naphtha lamps. One objection which may present itself against the use of these machines in a room, is the quantity of steam liberated: but this may easily be carried off by blowing the steam towards a fire, when it will ascend the flue. On the whole, it appears more than probable, that the power of these machines may be eventually so modified and exalted, as that they may hold an equal, perhaps a superior, rank, to the oft times troublesome instrument (for a lecturer especially,)—the frictional machine.

Mechanics' Mag.

Modes of Measuring the Depth of the Sea.

In a late article of the *Ann. de Chim. et de Phys.*, M. Aimé, describes an apparatus for sounding, in which a weight attached to the line, may, on reaching the bottom, be detached, so that the line is drawn up with very slight resistance. This apparatus is supplied also with a vessel for collecting water at different depths. M. Aimé has, with the assistance of this machine, made, at Algiers, a series of experiments at various depths from the surface, from about 350 to 2200 yards, from which he infers that the amount of gas absorbed by the water is nearly the same at varying depths, and that the same remark applies likewise to the saline constituents.

The annexed cut is a figure of the ordinary sea-gage employed when the fathom line cannot conveniently be used. A B, is a gage-bottle, into which is fixed the gage-tube E F, the upper end of which is hermetically sealed, and the lower immersed in mercury. This is inclosed for protection, in a tube G H, pierced with holes, which admit the water into the bottle; and the whole is crowned with a large empty ball, or a full blown bladder. To the bottom of A B, a large weight K, is connected by a spring.



The weight being attached to the instrument, they both sink, until, striking on the bottom of the sea, the weight is detached, and the globe I, is allowed to bring up the gage to the surface. In the descent, the water pressing on the surface of the mercury, causes it to rise in the gage-tube. By placing a small quantity of viscid matter on the surface of the mercury in the tube, the instrument becomes self-registering: the viscid matter will adhere to the tube at the highest level to which it is raised, and will, therefore, indicate the space into which the air in the tube has been compressed; consequently, the depth of the water which is reciprocally proportional to the space occupied by the air, may be ascertained.

Glasgow Mech. & Eng. Mag.

The Pendulum Marine Artificial Horizon.

The following letter from an officer employed last summer, in the survey of St. George's Channel, affords so remarkable an instance where the pendulum horizon, alluded to by Capt. Beechey, in our last, would have saved both time and anxiety for the safety of one of H. M. ships abroad, in which he happened to be serving, that we cannot resist the opportunity of quoting it here; and our satisfaction in doing so is increased on seeing it signed by that careful and well informed officer, the master of the *Lucifer*.

Greenwich, October 15th, 1843.

Dear Sir,—I am sorry that absence from town should have prevented my communicating to you, the opinion I have been able to form of your pendulum horizon, tried by us in the *Lucifer*.

The observations in your possession will speak for themselves. Although a stranger to the instrument, I found little difficulty in using it, and am of opinion that a moderately good observer, when accustomed to its use, may, at sea, under favorable circumstances, obtain altitudes within four minutes of a degree.

The great value of such an instrument must be obvious, and, although often placed in circumstances when it would have been invaluable, I will confine myself to one strongly impressed on my memory. In H. M. sloop *Zebra*, on our passage from Hobartown to Tahiti, we were enveloped in a dense fog, between the Snares and Lord Auckland's group, which lasted, as nearly as I can recollect, upwards of a week. Latterly, from the uncertainty of our position, it was considered necessary during the night to run a certain number of miles on opposite courses, to endeavor to keep, as nearly as possible, on ground that had been gone over. Although the fog was so dense that an object could not be seen at the distance of fifty yards, the sun was shining brightly over head, and, had your instrument been on board, I should not have felt the slightest anxiety, as the wind was light, and the water perfectly smooth. Could we, by any means, have obtained a latitude, even ten miles in error, it would have been most acceptable.

With every wish that it may come into general use,

I remain, &c.,

L. C. BAILEY.

We take the following from the *Shipping Gazette* of the 13th of March.

Sir,—Among the new inventions of the day, permit me, through your paper, to draw attention to Captain Becher's horizon, which is not so well known to the merchant navy as its merits deserve, for it is calculated to be of essential assistance in navigation. It is a pendulum horizon, to be attached to the sextant, and is admirably adapted for obtaining the altitude of the sun at places where the land intervenes, or in foggy weather, and no horizon, although there may be a clear sky over head, as is frequently the case, for example, on the Banks of Newfoundland, and elsewhere. The instrument affords us the means of obtaining the latitude at times when it could not otherwise be arrived at by observation. Having used the instrument for several years, I unhesitatingly recommend it to the notice of those interested in such matters. For a description of the pendulum horizon, with the various uses to which it may be applied, the reader can consult a small pamphlet by the inventor.

I remain, &c.,

HENRY DAVEY,
Master R. N.
Lond. Naut. Mag.

Stephen's Life-Preserver, or Portable Life-Ball and Line.

This apparatus consists of a hollow metal ball, about five inches in diameter, to which are brazed, or riveted, three eyes, and a line fixed, of about twenty fathoms, or upwards, in length, of half inch Hambro' layed rope, having a sliding thimble to form the noose. In order to prevent its being damaged, it is quilted over with net-work, similar to a child's ball, being, however, first cased with cork, so as to render it more buoyant. Through one of the eyes is rove the line which passes round the ball, and is again brought through the eye in the opposite direction; both parts are then seized together outside the eye, leaving sufficient line, with a thimble in the end, to form a bight. The standing part of the line is then passed through the thimble, and a noose formed sufficiently large to admit of it passing over a person's shoulders, to fasten round his waist. The other two eyes are placed opposite to each other, through which a piece of line is rove round the ball, and seized in four places, so as to form grummetts, or handles, to the "life-ball," in order that it may be the more readily held, or caught hold of.

The life-ball, from its portability, can be carried to any part of the vessel, and thrown in the direction of the person overboard; whereas the life-buoy, when put in operation on a casualty occurring, although it may be immediately let go and dropped, yet, from its nature, will remain stationary in the wake of the ship, and, unless the person be a good swimmer, it is almost impossible he can reach it, particularly should he happen to fall overboard to leeward, a circumstance which more frequently happens than otherwise.

Lond. Journ. Arts & Sciences.

The Diamond Mines of Brazil.—The diamonds occur in masses of Itacolumite, upon the left bank of the *Corsego dos Rois*, on the Serra du gramnagoa, forty-two Portuguese leagues north of the city of Tejuco, or Diamantina. The diamonds have been, for some years, profitably extracted by breaking up the rocks, and reducing the fragments to sand by means of hammers; they are then obtained by washing the sand. The washing, however, has now ceased, because of the increasing difficulties of extraction from the remaining rocks, as well as because diamonds are obtained with greater facility in other situations. A small diamond, separated from the Itacolumite, with which it was encased, has been examined by a commission of the Academy of Sciences; they have ascertained that it does not polarize light completely, and that its angle of maximum polarization is exactly the same as that given by a diamond from India, taken for the sake of comparison.—*Ann. de Chim.*

Platina in the Sands of the Rhine.—M. Dæbereiner has obtained 0.4 grain of platina, from one ounce of auriferous sand taken from the Rhine.

Lunar Occultations.

Lunar Occultations visible in Philadelphia during the month of July, 1844; computed by MRS. CHARLOTTE S. DOWNES, from the Elements published with the Occultation list of the United States Almanac.

The Immersions and Emersions are for Philadelphia, mean astronomical time. Im. for Immersion, Em. for Emersion. These abbreviations in *Italics* refer to those Immersions and Emersions which take place on the Moon's dark limb. N. App. for Near Approach.

The angles are for *inverted image*, or as seen in an astronomical telescope, and reckoned from the Moon's North point and from its Vertex around through East, South, West, to North and Vertex again. For direct vision add 180°.

JULY, 1844.

Day.	H'r.	Min.	Star's name.		Mag.	From North.	From Vertex.
1	8	50	Im.	τ^1 Capricorni,	6	68°	116°
	10	3	Em.			264	305
1	9	53	Im.	τ^2 Capricorni,	6	54	96
	10	59	Em.			272	306
8	16	21	Im.	γ Ariet's,	6	358	49
	16	36	Em.			303	336
17	6	52	Im.	Bessel,	9	154	103
	7	37	Em.			255	207
17	8	35	Im.	Bessel,	8	170	120
	9	4	Em.			234	186
18	7	17	Im.	Bessel,	7	118	69
	8	17	Em.			291	241
18	7	25	Im.	Bessel,	9	78	29
	8	13	Em.			331	281
18	9	11	Im.	Bessel,	9	183	133
	9	28	Em.			318	169
19	7	32	Im.	Bessel,	9	122	75
	8	34	Em.			287	237
24	6	13	Im.	δ Scorpii,	3	104	123
	7	33	Em.			281	282

JOURNAL
OF
THE FRANKLIN INSTITUTE
OF THE
State of Pennsylvania
AND
AMERICAN REPERTORY.

AUGUST, 1844.

CIVIL ENGINEERING.

Observations on Mr. Ellwood Morris' Remarks on Water-Wheels.
By Mr. JAMES WHITELAW.

From the Glasgow Practical Mechanic and Engineer's Magazine.

In Vol. II., pp. 221—224, of your Magazine, you have printed part of an article, written for the *Journal of the Franklin Institute*, by Mr. Ellwood Morris, C. E., entitled, "Remarks on Re-action Water-Wheels used in the United States, and on the Turbine of Fourneyron, an Hydraulic Motor, recently used with the greatest success on the continent of Europe." When I read the portion of Mr. Morris' paper referred to, I felt satisfied that his notions on many of the subjects which he had taken in hand to discuss, were incorrect; and, at the time, intended to show where he was in error; but my attention at the time being otherwise engaged, I deferred to write, and latterly, on reconsidering the matter, it occurred to me that it would be advisable to reserve my remarks till after I had read the remaining part of the paper. But as Mr. Morris' remarks on Turbines have not, up to the present time, appeared in your pages, I recently applied for, and obtained the numbers of the *Journal of the Franklin Institute* in which they are printed; and, as their perusal has not changed my opinions, I shall proceed to notice some points of the subject which Mr. Morris has undertaken to handle, without, seemingly, an adequate knowledge of the principles involved.

I may state, in the first place, that Mr. Morris has sadly undervalued the experiments of Smeaton, on overshot water-wheels, and

has attempted to give to the experiments, made by the Franklin Institute, an importance which they do not deserve. The following quotation from the paper of Mr. Morris, will, in some measure, serve to explain this: "The *coefficient of effect* of wheels of the first class [overshot water-wheels] is assumed, for our present purposes, at 0.700 to 0.800, in consequence of the able experiments of the Franklin Institute having shown, that, under favorable circumstances, even *eighty-four per cent.* of the power expended may be realized by overshot wheels, whilst Smeaton's experiments developed a ratio of power and effect of 3 : 2, giving 0.666 for the coefficient of effect."

It may be true that the Franklin Institute have shown, that "under favorable circumstances" even eighty-four per cent. of the whole power of the water may be obtained by overshot wheels; but Smeaton's experiments also prove that an overshot wheel is capable of giving as high a result. Mr. Morris will find this to be the case should he take the trouble to turn up p. 37, and consult table 2, of *Tredgold's Tracts on Hydraulics*, published in the year 1836, by Mr. Taylor, of London. I shall take the experiment marked No. 3, in the table to which I refer, to illustrate, and bear me out in this statement. The experiment is recorded in the following tabular form:—

No. of experiment.	Whole descent.		Water expended in a minute.		Turns at the maximum in a minute.	Weight raised at the maximum.	Power of the whole descent.	Power of the wheel.	Effect.	Ratio of the whole power and effect.	Ratio of the power of the wheel and effect.	The diameter of the water-wheel is 24 inches.
3	Ins.	Lbs.				Lbs.						
	27	56½			20½	12½	1530	1360	1167	10 : 7.6	10 : 8.4	

Now, this is a result of 84 per cent., in other words, a coefficient of effect = 0.84, which is the same as that which Mr. Morris informs us was obtained by the Franklin Institute.

It is true that I have here taken the case where the height of the head of water, which is above the water-wheel, is subtracted from the whole height of the fall; and I believe that the Franklin Institute, in the experiments referred to by Mr. Morris, calculated the coefficient of effect from the power produced by the whole descent of the water. But the height of the head of water above the wheel being only a very small fraction of the whole descent, when the fall is high, and, especially, when the water-wheel is broad, and has narrow shrouding, Mr. Smeaton's experiment may be reckoned, with all fairness, to give to the coefficient of effect (0.84) a value which may be considered correct for practical purposes.

Did I think it necessary for my purpose, I might extract from Mr. Smeaton's papers many examples of a different kind, to prove that Mr. Morris did not understand his subject when he wrote his "Remarks;" but I conceive that nothing further is required to bear me

out than the general statement, that in *every case* Mr. Smeaton's experiments gave a higher result than 66.6 per cent., even when he calculated the power from the whole descent. In the very experiment above quoted, the result, it will be observed, is 76 per cent.

I have neither seen a drawing, engraving, nor description of the apparatus which was used by the committee of the Franklin Institute in their experiments on water-wheels; but from specimens of their mode of reducing the results, which are in my possession, I am led to believe that their apparatus was complicated and clumsy, compared with that used by Smeaton, and am, therefore, inclined to think that the experiments of the former, though made on a large scale, are not more to be depended on than those of Smeaton, which were performed on a small machine. It is worthy of remark, that Mr. Smeaton did not allow enough for the friction of his model, else his experiments would have given to the coefficient of effect a value somewhat higher than they have done. And I may state further, that the Franklin Institute had money at their command, and Mr. Smeaton, though not assisted in that way, made experiments which the Franklin Institute could do no more than repeat; and, besides, Mr. Smeaton by his experiments, explained important laws, a knowledge of which is necessary to every mechanic, and especially to every one who attempts to discuss hydraulic motors.

Below I shall give the results of a few experiments, for the purpose of convincing Mr. Morris that he knows very little about the theory of re-action water-wheels. How he made up his mind to class *re-action wheels* with those of *impulse* (undershot water-wheels) puzzles my comprehension, as it appears to me that a good re-action wheel is as much a *wheel of pressure* as an overshot water-wheel is. Mr. Morris may have been led into error by the experiment which he made on something like a re-action wheel, but which is no more to be considered such, than the toy which children play with, composed of a small slip and rod of wood, a pin, and two D-shaped pieces of paper, is to be reckoned a wind-mill. Moreover, as an engineer, he should have known, that he could not, from his experiment, arrive at the true value of the coefficient of effect for re-action wheels.

I will not occupy your pages by explaining the theory of re-action wheels; but will, instead, furnish you with the results of some experiments, to prove that for any purpose where a usual degree of speed is required, the kind of re-action wheel which I invented, has, for its coefficient of effect, a value as high as that of an overshot wheel—and that .35 to .40 does not, as Mr. Morris supposes, represent the efficiency of a re-action water-wheel, any more than it does the specific gravity of the moon.

The following results were calculated by Mr. Randolph, from a series of experiments performed by him on a new water-mill, which he erected lately at a factory situated near Glasgow. At the factory there is a steam engine just powerful enough to drive the whole of the machinery, and the power of the water-mill is not so great as that of the steam engine. The water-mill and steam engine can be worked either separately, or together, at any time. The power of the mill

was determined by applying a Watt's indicator—of the kind made by Mr. M'Naught—to the steam engine, when working under different pressures of steam. This mode of testing will be readily understood from what follows.

The diameter of the cylinder of the steam engine is 31 inches, and the length of stroke 5 feet.

The water-mill has a fall of 15 feet, and uses 2000 cubic feet of water per minute. By taking .75 for the coefficient of effect, the power of the water-mill would thus be equal to that of 42 horses.

Results of Experiments.

1. Steam engine, working alone, at 24 revolutions per minute—mean pressure of 3 diagrams = 1.626 lbs. per square inch.
2. Steam engine, driving whole factory, at 23.5 revolutions per minute—mean pressure of 2 diagrams = 12.275 lbs. per square inch.
3. Steam engine, driving whole factory, at 22.5 revolutions per minute—mean pressure of 4 diagrams = 12.4 lbs. per square inch.
4. Steam engine, assisting water-mill, at 23 revolutions per minute—mean pressure of 3 diagrams = 3.9 lbs. per square inch.
5. Steam engine, assisting water-mill, at 22.75 revolutions per minute—mean pressure of 4 diagrams = 3.72 lbs. per square inch.

From these data we readily arrive at the following results, by the mode of calculations indicated:—

No. 2. minus No. 1. = $(12.275 - 1.626)$ lbs. = 10.649 lbs. effective pressure on cylinders when the steam engine is driving the whole factory at 23.5 revolutions.

No. 4. minus No. 1. (= $3.9 - 1.626$) lbs. = 2.274 lbs. effective pressure on cylinders, when steam engine is assisting water-mill at 23 revolutions.

And $(10.649 - 2.274)$ lbs. = 8.375 lbs. pressure, which gives to the water-mill a power equal to that of 45 horses, and, making the deduction according to M. Morin, for the additional friction of the engine when loaded, this becomes 41.63 H. P.

No. 3. minus No. 1. = $(12.4 - 1.626)$ lbs. = 10.774 lbs. effective pressure on cylinder, when steam engine is driving the whole factory at 22.5 revolutions.

No. 5. minus No. 1. = $(3.72 - 1.626)$ lbs. = 2.094 lbs. effective pressure on cylinder, when steam engine is assisting water-mill at 22.75 revolutions.

And $(10.774 - 2.094)$ lbs. = 8.68 lbs. pressure, which gives to the water-mill a power equal to that of 44.6 horses, and deducting, as before, for the additional friction of the engine, this shows an available power of 41.26 horses.

The mode of testing, here adopted, is, perhaps, the most direct, and therefore, the most to be relied upon of any which could be applied, and shows, practically, that the coefficient of effect does not fall appreciably short of 0.75.

In the two series of experiments which follow, the power of the water-mill was tested by means of M. Prony's brake, and the water expended was accurately measured in a box.

The diameter of the water-mill is only $7\frac{1}{2}$ inches.

The length of the arm of the friction brake, in feet, is

$$\frac{10}{8.1416 + 2}$$

The experiments were made by Messrs. Randolph and Cunliff, of Glasgow, and myself.

RESULTS.—1. SERIES.				
Height of fall in feet.	Cubic feet of water per minute.	Revolutions of the water-mill per minute.	Weight on the friction brake.	Power in per cents.
10.42	10.95	813	10 oz.	71.5
10.32	10.9	800	10 oz.	71.3
10.23	10.76	792	10 oz.	72.2
10.13	10.6	778	10 oz.	72.7
10.06	10.4	730	10 oz.	70.7
RESULTS.—2. SERIES.				
9.84	10.87	813	$9\frac{1}{4}$ oz.	70.5
9.64	10.6	783	$9\frac{1}{4}$ oz.	71.1
9.52	10.4	768	$9\frac{1}{4}$ oz.	72.0
9.38	10.28	755	$9\frac{1}{4}$ oz.	72.6
9.33	10.12	730	$9\frac{1}{4}$ oz.	71.7

Messrs. Escher, Wyss & Co., of Zurich, Switzerland, and Mr. John Hamilton of the same place, have obtained a result of about $\frac{3}{4}$ ths of the power of the water from a number of water-mills which they have erected on low falls; and, along with others, I have obtained from a water-mill, which was tested by the friction brake, a result of 78 per cent. of the power of the water.

As Mr. Smeaton, and, I believe, the Franklin Institute, have considered the power required to overcome the friction of the gudgeons, and the resistance which the atmosphere offers to the motion of the water-wheel, part of the effect—I might have done so too, and thus have increased the above results, which give the actual, or available, power of the water-mill, and nothing more; but by reckoning up, with the power, the quantity consumed in working the machine itself, a result greater than what the machine can give out to work machinery is obtained,—which does not seem to me altogether correct, or fair. I should, however, observe, in relation to the preceding results, that I do not expect the same per centage from a model of the size from which they were obtained, as from a larger sized machine.

Mr. Morris, had he studied his subject a little more closely, would not have so hastily arrived at conclusions grounded upon first notions—he would not have allowed himself to be deceived by appearances,

which are almost inseparable from a machine of such construction as that of the turbine of M. Fourneyron. For example, he ought not to suppose, when he sees the water falling directly downwards from that machine, when in motion, that the fluid has spent all its force before leaving the orifices. For it is possible, and, indeed, very likely to be the case, that the water outside, and close to the turbine, is deprived of a great portion of its force, by adhering to the inclined exterior surfaces of the water passages in the revolving part of that machine. The water may adhere to the edge of the turbine, for the same reasons that Hall's hydraulic belt lifts water; and, therefore, the machine may be deprived of a large amount of its power, by simply acting against the force of the escaping water, thereby bringing it nearly, or altogether, to a state of rest, or even, in some cases, entirely reversing its motion.

From this remark, Mr. Morris will see how it is possible that the turbine may be improved; and, I may remark further, for his benefit, that the turbine, in some of its best forms, is neither more, nor less, than a very complicated re-action water-wheel; still further, that my water-mill is, from its superior simplicity and efficiency, fast superseding the use of the turbine on the continent of Europe. Messrs. Escher, Wyss & Co., of Zurich, have lately taken down five new turbines, and replaced them with the new water-mill—and these gentlemen, and other engineers of eminence, a few months ago, tested, by means of Prony's brake, several turbines, and did not obtain from one of them any thing like so high a result as Mr. Morris says may be realized by that hydraulic motor.

Mr. Morris is, I dare say, a gentleman of talent, and should he take the trouble to study his subject before putting it on paper, may become an honor to his country; but if he persist in the incautious course, which he seems to have laid out for himself in his "Remarks," he will, to a certainty, deserve to be classed amongst those edifying authors who write stories about the "Great Sea Serpent,"—and may find a companion in him who told us lately that the "almighty particular riot" of the Falls of Niagara had been quashed in the twinkling of an eye.

Paisley, 22d March, 1844.

Remarks on the above Letter. By ELLWOOD MORRIS, C. E.

The mere fact of the above letter having found a place in the Glasgow "*Practical Mechanic and Engineer's Magazine*," imparts to it an air of respectability, which will, I hope, justify me in noticing a few of its misstatements.

My former remarks in this Journal on "*Re-action Water-Wheels used in the United States, &c.*," were merely designed to throw into a condensed form such popular information, relative to water-wheels, as would enable the general reader to compare, without trouble, the relative merits of the well known family of re-action water-wheels, in common use here, and of the turbine of Fourneyron, just then being introduced in America.

In every conclusion, that was therein drawn, I am fully sustained by the practice of the country, with the re-action water-wheels referred to.

I did not allude to the water-mill of Whitelaw and Stirratt, simply because it did not come within the scope of my design, and, certainly, I had no idea that such omission would draw down upon me the assault of an individual whom I neither thought of at the time, nor could, for a moment, have regarded as an authority of such weight in hydraulic affairs, as to require propitiation.

Tredgold's Tracts on Hydraulics, (from which Mr. Whitelaw quotes,) are well known in this country; and, it so happens, that from Smeaton's "*Observations and Deductions*," therein recorded, on page 38, I drew the statement that his experiments gave 0.666, as the coefficient of effect of an overshot water-wheel. On the page referred to, Mr. Smeaton says:—

"The effective power must be reckoned from *the whole descent*. . . . The ratios between the *powers*, so estimated, and the *effects* at the *maximum*, deduced from the several sets of experiments, are exhibited in one view, in column 9, of table 2; and from hence it appears, that those ratios differ from that of 10 to 7.6, to that of 10 to 5.2; that is, nearly from 4 : 3 to 4 : 2 by a medium of the whole the ratio is that of 3 to 2, nearly."

Now the ratio of 3 to 2, certainly gives 0.666, for the coefficient of effect, as was stated by me.

The single experiment quoted by Mr. Whitelaw, was clearly regarded, by Smeaton, as insufficient to establish a coefficient of 0.84, or even 0.76, for overshot water-wheels in practice, and, however highly the former may estimate his own capacity to generalize the results of those celebrated experiments, the rest of the world, will, probably, agree with me, that it is infinitely inferior to that which adorned the illustrious Smeaton himself.

The experiments made upon water power, by the Franklin Institute, having already received the sanction of the highest authorities in hydraulic science, it would be wasting space to defend them against such an assailant as Whitelaw, especially as the latter, whilst (with rare assurance,) pronouncing their apparatus "complicated and clumsy," declares, in the same breath, that he has "neither seen a drawing, engraving, nor description" of it!

Notwithstanding Mr. Whitelaw professes great ignorance relative to the experiments of the Franklin Institute, it is a singular fact, that under date of June 5th, 1832, he wrote, from New York, a letter to the editor of the *Journal of the Franklin Institute*, on the subject of water-wheels, which was published in the August number for that year, (see *Journ. Frank. Inst.* for 1832, vol. x, p. 73.)

This letter described the principle of the improvements made in Barker's mill, by curving its arms, which are now known here as the "Scotch motor;" and in Europe as "Whitelaw and Stirratt's patent water-mill;" and, we may here remark, in passing, that under our patent law, this letter will prevent him, or his agents, from securing

to themselves, by letters patent, subsequent to August, 1832, any thing which is described in his "*printed publication*" of that date.

In this same tenth volume, containing the letter spoken of, a number of the experiments of the Franklin Institute, on water power, are described, and drawings, of part of the apparatus used, are given.

The Journal of the Franklin Institute, was, therefore, so familiarly known to Mr. Whitelaw, in 1832, that he was one of its correspondents:—the report on water power formed, at that time, a prominent portion of its contents, and yet he pretends ignorance of that report!

In Mr. Whitelaw's letter published above, he makes an assertion, which, if it be a fair specimen of the dependence to be placed on his allegations generally, would inscribe him very low, indeed, upon the roll of truth.

It will be seen that he alleges, unequivocally, "*that IN EVERY CASE Mr. Smeaton's experiments gave a higher result than 66.6 per cent., even when he calculated the power from the whole descent.*"

This is certainly erroneous, and displays, on Mr. Whitelaw's part, a lamentable ignorance of the contents of the book he had before him, as is proven by the paragraph already quoted from page 38 of *Tredgold's Tracts*, and by the 9th column of Smeaton's table 2, page 37, which we give below, to wit:—

Number of Experiments.	Ratio of the whole Power and Effect.
1	10 : 6.9
2	10 : 6.9
3	10 : 7.6
4	10 : 7.3
5	10 : 7.3
6	10 : 7.0
7	10 : 6.8
8	10 : 6.5
9	10 : 6.6
10	10 : 6.5
11	10 : 6.6
12	10 : 6.1
13	10 : 5.9
14	10 : 6.5
15	10 : 5.9
16	10 : 5.2

Now, it appears from the above 9th column of the table quoted, that so far from Smeaton's experiments giving a higher result than 66.6 per cent., "*in every case,*" as Mr. Whitelaw has asserted, *seven out of the sixteen experiments tabulated, actually give results much below that limit!*

After having thus exposed this misrepresentation, upon which Mr. Whitelaw has chosen, in specific terms, to rest his case, I will conclude, by observing, that the accuracy of the results obtained from the Turbine of Fourneyron, rests upon the safe authority of MORIN, and other distinguished French philosophers, whose names will live in the archives of science, when that of Whitelaw shall have passed into deserved oblivion.

On the Pyramids of Egypt. By J. J. SCOLES, Esq., M.I.C.E.

(Continued from page 12.)

The pyramid of Meydoom is called the false pyramid, because the base is supposed to have been formed out of a knoll of rock, and it certainly has that appearance. The base is about 530 ft. square, and 124 ft. 6 ins. high. It is formed in three degrees, each having the form of a truncated pyramid, at an angle of $74^{\circ} 10'$. The blocks are of compact limestone 2 ft. thick; they are laid at right angles to the external face, and have been worked and put together with great skill. The entrance was not discovered. Mr. Perring thinks the whole has probably been covered with large unsquared blocks, so as to complete the shape of a regular pyramid. The appearance is very striking from the river, and particularly commanded the attention of Mr. Scoles, and his fellow travelers, in passing up the Nile.

The Illahoon pyramid is built round the knoll of a rock, which is nearly 40 ft. higher than the base; the rock has been faced with crude bricks, and a superstructure has been erected over it, composed of the same material, and supported by walls of stone which proceed from the centre of the edifice. The bricks are laid in a mortar formed of Nile earth, as high as the walls extend, and above them in gravel. They measure $16\frac{5}{8}$ ins. by $8\frac{3}{8}$ ins., and about $5\frac{1}{2}$ ins. in thickness, are well worked, and are formed of Nile earth, mixed up with various proportions of chopped straw, and are marked with the fingers as at Dashhour.

Another ruined brick pyramid exists at Howarah; the bricks laid in fine gravel. No entrance to it has been discovered. There are three other pyramids, two at Biahhmo, and one at El Koofa, both built of stone, but of small dimensions.

Most of the pyramids have been connected with the plain by inclined causeways formed of large blocks of stone, some with a parapet wall on each side. These inclined roads were, no doubt, originally constructed for the conveyance of the stone, and of the other materials used in the erection of the pyramids, but they seem afterward to have constituted the regular approaches. Herodotus mentions that they were adorned with the figures of animals, which were probably either sculptured hieroglyphics, or an avenue of sphinxes; and at Abouseer fragments of black basalt, at nearly equal distances, were found on the causeway. Pavements about two feet in thickness extended around the buildings, and where the rock was low the pavement was placed upon a layer of sand.

The pyramids correspond in their general arrangement; with one exception, their sides are placed exact to the cardinal points, and in the excepted one the difference is only $4^{\circ} 35'$; the entrances are on the north side, (the pyramid at Sakharah being the only one having, in addition, an entrance on the south side,) and in having the inclined passages leading to various apartments, which passages, to a considerable way down, have been filled up with solid blocks of stone, or granite of the exact size of the apertures.

The discovery of sarcophagi, mummies, and other memorials of the dead, show that the pyramids were used for tombs, and the filling in of the passages with solid blocks proves that the interior could not have been used for astronomical purposes, and the question of those passages having been constructed for the purpose of seeing the Polar Star, is set at rest by that circumstance; and Colonel Vyse, in his desire to further elucidate the question of the astronomical theory, communicated with Dr. Herschell, and has appended that distinguished astronomer's reply, which is to the following effect, viz:—"That 4,000 years ago, the present Polar Star, or Ursa Minoris, could, by no possibility, have been seen at any time in the twenty-four hours through the gallery in the great pyramid; but that the star α Draconis was, at that time, the Polar Star, and as it is comparatively insignificant, and only of the third magnitude, if so much, it can scarcely be supposed that it could have been seen in the day time, even in the climate of Ghizeh, or even in such a recess as the inclined entrance of the Great Pyramid, though it would have been directly in view of an observer stationed in the descending passage. No other astronomical relation can be drawn from the table containing the angles and dimensions of the passages, for although they all point within five degrees of the pole of the heavens, they differ too much and too irregularly to admit of any conclusions. The exterior angles of the buildings are remarkably uniform, but the angle of 52° is not connected with any astronomical fact, and was probably adopted for architectural reasons."

Col. Vyse's work also contains some valuable information in the form of notes by Mr. Birch, of the British Museum, upon the hieroglyphics discovered in the pyramids, with reference to the dates, prenomens, and royal standards of the monarchs by whom the pyramids were erected; but many of these hieroglyphics are quarry marks, some in red ochre, but instead of having been inscribed, like those on the pyramids at Ghizeh, upon stone brought from the Mokattam quarries, they were found also upon blocks quarried on the spot, and Mr. Birch observes,—“This is remarkable; in the former instance they may have been intended to distinguish the materials which had been prepared for a royal edifice, but in the present case their use is not obvious, and they can only have served to denote the founder of each particular pyramid.” But Mr. Harris, an English merchant, who has been resident in Egypt above twenty years, in a letter to Mr. Perring, gives a more matter of fact meaning, by supposing that these inscriptions were directions to guide those who embarked the stones at the quarries, who conveyed it to its destination, and who built it when there, and that some of the characters indicate the building for which the stones were destined, and others the position in which they were to be placed, and that these directions could not be necessary to all the stones of a building, but would be requisite for all, or most, of those composing the linings of the chambers, passages, and other particular positions.

The desecration of these magnificent mausoleæ, by the intombment of subjects, as the inscriptions relate to the interments of a royal

scribe, and a military chief, is a surprising fact, which cannot now be satisfactorily accounted for; although history informs us that the memory of the monarchs who erected some of the pyramids was not held in much veneration.

As regards the period in which the pyramids were erected, Mr. Scoles could not offer any satisfactory opinion; by some authors they are placed more than 2000 B.C., or about 4000 years since; by others 1200 years later, or only 2300 since. This latter opinion is supported by Mr. Wathen, an architect, who, in his work on the arts, antiquities, and chronicles of ancient Egypt, from observations made in 1839, has very fully entered into this subject, and supposes the spoils, the gold and silver, taken from the Temple of Solomon, by the king Shishak of Scripture, 970 B.C., were applied to build these pyramids, and the author has given some curious dissertations on the chronology and dynasties of ancient Egypt. Many circumstances show that those at Ghizeh were the first erected, and that the pyramids of Dash-hour were constructed in imitation of the stone ones, and to have been formed of bricks on account of the comparative cheapness.

The circumstance of many of these pyramids being carried up in degrees, or steps, agrees with a passage in Herodotus, relative to the mode of building the large pyramid, which he describes as follows:—"This pyramid," (the large one) he says, "was constructed in the manner of steps, by some called parapets, by others little altars; such being its original construction, they raised the remaining stones with machines made of short pieces of wood, from the ground to the first layer of steps, and when the stone was let down on this, it rested on a second machine standing on the first layer, from this it was drawn to a second layer, where another machine lay to receive it, for there were just as many machines as layers of stones, or, perhaps," continues Herodotus, "they transferred the same single portable machines to each layer on removing the stone, and thus the upper part of the pyramids was first finished off, then the next part, and last of all the lower ground part. Now these parapets, as they are termed, correspond with the side degrees, or platforms, as we would call them, seen in these pyramids, and on which the machines were placed; for the small steps formed by the sets-off of each course, as were seen in the large pyramid, previous to the insertion of the casing stones, would not have been wide enough for the machines to rest on."

The word parapet, as used in the translation, does not mean a protecting wall to a platform, as we, in general, understand it, but evidently the platform, and, in the north of England, it is so applied at the present time, and the foot pavement is called the parapet.

As connected with the pyramids, Col. Vyse has given an account of Capt. Caviglia's excavations in 1818, in front of the sphinx; when he discovered the steps, and a small temple in front of this gigantic figure, which is cut out of the solid rock. The paws stretch out 50 ft. in advance, and are built of masonry. That the monument is imposing in its aspect, cannot be doubted; but in its defaced state, it is difficult to perceive (to quote the words of the explorer,) the contemplative turn of the eye, the mild expression of the mouth, and the

beautiful disposition of the drapery at the angle of the forehead, which rivetted so much the attention of Capt. Caviglia.

Mr. Perring has annexed some remarks on the measure by which the pyramids were built, with reference to the cubit. The length of the ordinary cubit, as the name implies, was the distance from the elbow to the middle finger, containing six hands breadth, each of which was divided into four finger breadths. Mr. Perring says the dimensions of the pyramid agreed with a cubit as described in Ezekiel, chap. xl, v. 5, "In the man's hand a measuring reed, of six cubics long by the cubit, and a hand's breadth," and, therefore, contained seven hand's breadth, equal, in English feet, to 1.707 ft., and that by this measure a general agreement is obvious in the dimensions of the building.

The stone arched tomb near the great pyramid, named after Colonel Campbell, the Consul in Egypt, was next referred to; by some called the Nile girt tomb, being placed in a pit 30 ft. 6 ins. by 26 ft. 3 ins. wide, 53 ft. deep, surrounded by a trench, or narrow canal, 5 ft. 4 ins. wide, and 73 ft. deep. The bottom course of slabs, 5 ft. in length, was bedded on a layer of sand 2 ft. 6 ins. thick, (another instance of this mode of forming an artificial foundation,) and the side walls were formed with small stones. The ceiling of the chamber is formed of slanting stones, with a horizontal one, or stretcher, between, making the middle part of the ceiling flat, and the sides inclined. Immediately above this ceiling an arch commenced, which covered in the upper chamber; the intrados of this arch formed the segment of a circle which had a radius of 6 ft. 2 ins., and a span of 11 ft., was 3 ft. 10 ins. thick, composed of four separate courses, each well breaking joint. It had not been built upon a centering, observes Mr. P., (but how he ascertained this does not appear.) The stones were 4 ft. long, and 15 inches broad. Those of the first course had been cut to fit the joints, which radiated from the centre; with this course great care had been taken, but in the other rings the stones were rectangular, and packed up at the back with chips. Each course was separately grouted with fluid mortar. The masonry was beautifully worked, and the joints were scarcely perceptible in the interior. The undersoil of the stones of the inner course of the arch, have had the arrisses taken off, and were tooled round so as to resemble rusticated work.

There were indications that the central excavation, and the trench, also, was covered by an arch, and the whole was probably covered by a pyramid. From an inscription on this monument, the tomb was made for a scribe named Ohaikop, either during the reign of Psammetichus II, anterior to 604 B.C., or of Apries, posterior to 570 B.C. This tomb contained three sarcophagi: one of the granite, and a fragment of the basalt one is now in the British Museum.

This arch being, in the present day, one of ordinary construction, would not have required so full a description, if it were not about the oldest stone one we are acquainted with; it shows that the principle of the arch was well understood at the time, and that many arches

had been previously formed. The brick arches in the tombs at Thebes, are of much older date, according to Sir Gardner Wilkinson.

It was worthy of notice that the arch of Campbell's tomb had no abutments, and stood by itself, and its resemblance to the form of the sewers in the city of Westminster, must be apparent to every one conversant in that mode of building.

It was singular the Greeks, with these examples before them, did not construct arches (the curved form for ceilings being much used,) and that the introduction of the arch was not, with these exceptions, more general, at least, in Egypt; and Mr. Scoles expressed himself on this account skeptical on the subject of the antiquity of these arches. He was of opinion that the arrangements and dates of the dynasties by Egyptian antiquaries, was not so satisfactorily based as to make it clear to his mind that the period in which the kings lived, in whose reign these arches are said to be built, was free from the suspicion of error, and he concluded his paper by remarking, that the descriptions he had given of the pyramids, and other buildings, were entirely taken from Colonel Vyse's work, and that, in general, he had used the very words of the text.

Civ. Eng. & Arct. Journ.

The Patent Wire Rope.

We have so often noticed in our columns the superiority of wire rope over hempen, for mines, railways, standing rigging, &c., that further remark would almost appear superfluous; but having lately had our attention particularly directed to an additional instance of its especial advantages for the latter purpose, we cannot avoid the opportunity of again noticing some of its peculiarly valuable features. It has now been in use about eight years, and many vessels, both in her majesty's navy, and the merchant service, have had their standing rigging constructed of this material for nearly that period, and, in every case, it has proved its superior durability, lightness, and economy, when compared with other descriptions of rope—requiring no change, or repairs, for ten, or twelve, years, which the patentee is ready to guarantee—being less than half the weight and size of hemp rope of the same strength, and 20 per cent. cheaper on first cost. Numerous testimonials from the owners and captains of vessels, both in the Royal navy, and mercantile marine, are convincing proofs of its indestructibility, after wearing for a period which would see out nearly three suits of hemp rigging. From among many others we subjoin the following testimonial of its superiority, from the owner of the schooner *Marshall*, (which vessel is now lying in the 'Thames,) as being one of the first vessels to which Mr. Andrew Smith's wire rope was applied, and which fully bears out the above facts:—

Sir,—I have much pleasure in stating, that my schooner has been entirely fitted with your patent wire rope, as standing rigging, for nearly eight years, and it now appears as good as when put over the mast-head; during that time the schooner has been constantly afloat, and trading in the Baltic and coastwise.

T. MARSHALL.

Account of some Experiments on a Vessel called the "Liverpool Screw," fitted with Grantham's Engines, and Woodcroft's Screw Propeller. From the Minutes of the Proceedings of the Institution of Civil Engineers, Feb. 13, 20, and 27, 1844.

The *Liverpool Screw*, upon which the experiments, described in this paper, were tried, is a small iron vessel 65 ft. long by 12 ft. 6 ins. beam, and 3 ft. 9 ins. draught of water. She is propelled by two high pressure oscillating engines, with cylinders of 13 ins. diameter, and 18 ins. length of stroke. The steam, which varies from 56 lbs. to 60 lbs. pressure in the boiler, is admitted to the piston for one-fourth the length of the stroke, the remainder working by expansion. The nominal power was 20 horses, but the effective power rarely exceeded $18\frac{1}{2}$ horses. The cylinders are placed diagonally, at right angles to each other, and work to one crank upon the main driving shaft, which runs direct to the propeller without gearing, or bands. The propeller, which makes 95 revolutions per minute, is on Woodcroft's plan, with a pitch expanding from 10 to 11 ft.; after being enlarged at three several times, from 3 ft. 10 ins. diameter, it is now 5 ft. 4 ins. diameter by 20 ins. long; it is of wrought-iron, and consists of four short arms, whose united area is equal to 16 square feet; of this only about 13 ft. are immersed, a portion of the upper side being constantly above the water; the angle of the centre of the floats is 45° , and about 40° at the periphery. The author then gives the details of a number of experiments, and he states, that, although the proportions of the vessel were not favorable for speed, her length being only five times the beam, and the sectional displacement 28 feet, the speed was greater than that of all the steamers on the Mersey, except the large sea going steam vessels. That the "slip" of the propeller, when tried by Massey's log, was less than five per cent. That the action of the screw across the way of the vessel, did not appear to affect the steering, or have the slightest tendency to turn the head of the vessel.

The author is of opinion, that engineers, in general, fearing a loss might take place from lateral action, with a long pitch, and that the steering would be affected if the propeller was not immersed, have made the propellers too small, and that the short pitch, which had rendered a high velocity necessary, was detrimental. Several satisfactory experiments, in towing vessels, are also mentioned, and, it is stated, that in a heavy sea, the superiority of the screw propeller was very visible. The dimensions are then given for vessels of war and commerce, working with screw propellers, driven direct by oscillating engines, which, the author anticipates, would prove much more serviceable and sea worthy, than any of the paddle-wheel steamers now in use.

The paper is illustrated by a diagram of the propeller of the *Liverpool Screw*, and by plans of the machinery and general arrangements of the proposed frigate and steamers.

Remarks.—Mr. Rennie observed, that the Institution was much indebted to Mr. Grantham, for bringing forward the subject of screw

propellers; the more particularly as it had now become of national importance, and that every attempt at perfecting the sub-marine propeller merited encouragement. It was difficult correctly to assign the merit of the first invention of this species of propeller, as it had been tried at various periods, and with as varied results, on the Continent, in the United States of America, and in this country;* but it appeared certain that Mr. Samuel Brown, the inventor of the gas vacuum engine, was among the first who applied the sub-marine propeller with any practical effect. The propeller used by him was on the principle of a regular screw, and consisted of two blades, which were affixed at an angle of 45° to a horizontal shaft, which was placed in the bow of the vessel, and he believed that it had also been used in the stern. This propeller was driven by a gas vacuum engine, of the nominal power of 12 horses, and actually caused a vessel of 60 feet in length, to move at the rate of six, or seven, miles per hour. M. Sauvage, of Boulogne-sur-Mer, had also made several attempts at propelling vessels by the same means, and it was very gratifying to find that his services had recently been acknowledged and rewarded by the King of the French. It was, however, Mr. F. P. Smith, who first rendered the screw propeller practically useful; for his perseverance, being aided by spirited capitalists, induced the building of the *Archimedes* steamer, the machinery of which was constructed by Messrs. G. & J. Rennie, in the year 1839. The results obtained from that vessel were well known, and caused the subsequent construction of the *Princess Royal*, the *Great Northern*, H. M. S. V. the *Bee*, the *Rattler*, and the *Dwarf*†, formerly the *Mermaid*, a model of which was exhibited, with the various forms of screws used in the different

Fig. 1.

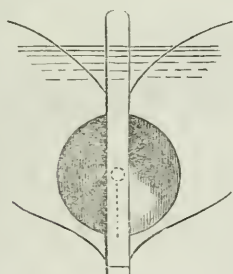


Fig. 2.

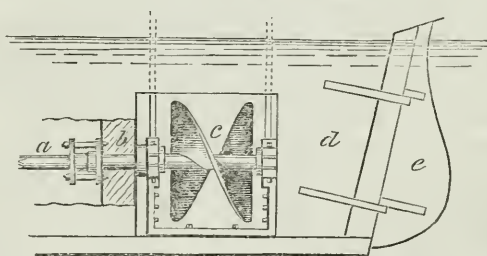


Fig. 2, a, Shaft; b, Stern-Post; c, Screw; d, Dead-Wood; e, Rudder.

* The dates of the experiments on screw propellers are nearly in the following order:—

Baron Seguier	1792	Cummerow, ...	1828
Fulton, ...	1796†	Sauvage, ...	1832
Shorter, ...	1802	Woodcroft, ...	1832
Trevithick, ...	1815	Ericson, ...	1836
Millington, ...	1816	Smith, ...	1836
Lowe, ...	1817	Lowe, ...	1838
Whytock, ...	1819	Hunt, ...	1839
Perkins, ...	1824	Rennie, ...	1839
Brown, ...	1825	Blaxland, ...	1840
Woodcroft, ...	1826	Carpenter, ...	1841

† In a letter to Dr. Cartwright, dated Paris, February 16, 1798, Fulton says, "I have just proved an experiment on moving boats, with a fly of four parts, similar to that of a smoke jack, and I find this to apply the power to great advantage, and it is extremely simple."

experiments. The *Great Britain*, not having yet been to sea, could only be mentioned as a projected experiment. Figures 1 and 2, are drawings of Mr. Smith's Double Threaded Screw, adopted in the "Archimedes."

The *Dwarf* was 130 feet in length, 16 feet 6 inches in breadth, 9 feet deep, and was 164 tons burthen. The power of the engines was 90 horses, making from 30 to 32 strokes per minute. Friction wheels without teeth were first tried for giving motion to the propeller; but on account of their slipping, and being very noisy, they were abandoned, and two spur morticed-wheels with wooden teeth, working into iron pinions, were substituted; the speed thus attained was from 150 to 160 revolutions per minute. The propeller was of cast iron, and was moulded in loam without a model, by means of iron templates cut to the required curve, which was formed from a solid cone revolving on its axis during the perpendicular descent of a tracer. The advantage of this form, over the cylindrical screw, was an increasing pitch, so formed, that while the propeller was rotating on its axis, the vessel was advancing, and thus producing the least possible amount of "slip." This was exemplified by the form of the various models on the table. The principal point to be obtained in a screw propeller, was a form which should offer but little obstruction to the water, and yet act upon it so as to exert full power in propulsion; a large portion of a complete screw having no useful effect, had induced the introduction of propellers with several blades; thus doing away with the useless part of the surface. A great portion of the centre part of the screw of the *Archimedes* had been cut away, but the effect had not been so good, on account of the arms of the screw obstructing the free passage of the water; the propellers with three arms, were, he believed, preferred to those with a larger number. The *Dwarf*'s propeller consisted of three curved blades, formed on the conoidal principle, by variable curves, approximating to angles of from 27° to 30° , and advancing at the rate of 7 feet 6 inches per revolution. It was 5 feet 10 inches in diameter, by 2 feet deep in the direction of its axis, and the area was about 15 square feet, which was nearly one-fourth of the area of the midship section of the vessel at light draught; but since the *Dwarf* had been transferred to H. M. service, the mean draught had been increased one foot, and the area

Fig. 3.

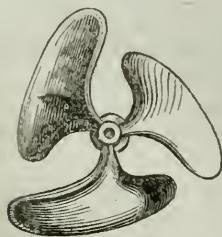
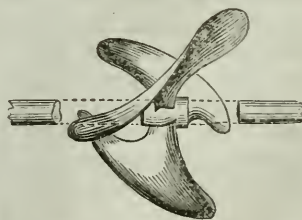


Fig. 4.



of the midship section in proportion; her speed had, in consequence, been reduced from 12 to 11 statute miles per hour. Figs. 3 and 4, are drawings of Mr. Rennie's Conoidal Screw Propeller.

The following were the results of the trials made by Captain Sir Edward Parry, Mr. Lloyd, and Mr. Murray, at the measured mile in Long Reach, on the 15th May, 1843:—

		Stat. Miles.	Mean.
1st experiment against tide,		9.890	} 12.145
2nd " with tide,		14.400	
3rd " against tide,		9.756	} 12.078
4th " with tide,		14.400	
5th " against tide,		9.890	} 12.203
6th " with tide,		14.516	
General average,			12.142
			Statute Miles per hour.

The draught of water was 5 feet 8 inches.

The Dwarf, under the command of Lieutenant Nicholls, left Greenhithe in company with the Hecate, Captain Bower, on the 14th of January, 1844, and reached Portsmouth on the following day; on the 20th she left Portsmouth, accompanied by the Hecate, and although it was necessary to reduce the speed of the engines to 26 revolutions, in order to keep with her consort during the night, they reached Falmouth on the 21st, after an additional run towards the Scilly Islands, making a distance of 200 miles in 23 hours, having burned 10 tons of coals in 27 hours, from the time of getting the steam up. The two steamers left Falmouth on the 23d, and reached Bear Haven on the following day, having run $135\frac{1}{2}$ knots, or 156 miles, by the log, in rough weather in 12 hours, and with bad coals; the engines making from 28 to $29\frac{1}{2}$ revolutions per minute. She anchored during the night at Bear Haven, and, on the following day, (the 26th,) reached Tarbert, the total distance from Falmouth being upwards of 400 miles.

Mr. Galloway said, that it was extremely difficult, if not impracticable, to arrive at the true amount of the "slip" of the propeller, because from its position abaft, or, in what is termed the dead-wood of the vessel, it acted in a current which was continually flowing to fill up the cavity, which would otherwise be formed by her progress through the water. The relative motion of a stream through the arches of a bridge, and in the wake of its piers, was an apt illustration of what unquestionably took place, (and from the same law,) in the case of a moving vessel. The screw, therefore, when acting in this current, might be compared to what would occur, if a paddle-wheel steamer was supposed to be moving in still water, while the floats acted in side canals, which flowed in the same direction as the vessel. Whether the benefits derived from this following current giving resistance to the screw, were not counteracted, by the deduction of so much of what is termed minus pressure from the ship itself, was not at present under consideration. His object was to show, that an accurate estimate of the amount of "slip" of a screw, could not be arrived at, until the rate of the following current, was first ascertained. That the "slip" must be much greater than Mr. Grantham assumed, would, he thought, be admitted, both from the circumstance he had stated, and from the fact that screw propellers, when worked with the

vessels at their moorings, invariably moved at a ratio at least equal to one-half the speed obtained when running. It was clear, therefore, that the "slip," which was dependent on the proportion of the resistance of the screw, compared to that of the vessel, must always exist in a degree; but that, it might in the screw, be reduced below that of the paddle-wheel, was evident, because in the best modifications of wheels, or where the immersed segment was small, the paddle must turn in the water, in effecting a change of position from its angle of entrance to that of its emersion, and this unavoidable angular action, even when the upper edge of the float coincided with the rolling circle, was still so much "slip" inevitably encountered; this "slip" too became very considerable when the vessel was in a sea-way; but the "slip" of the screw decreased with its magnitude, and, in the like proportion, its action approached that of a screw moving in a solid. It appeared, therefore, to him, that if the "slip" was small, the spiral, or increasing pitch, would be a disadvantage, because a true screw, would, under those circumstances, create little, or no, disturbance; while the spiral, in that case, would have the contrary effect, for the same reason that a helix would pass with facility through a solid, in which a spiral, or untrue, thread would become fixed, or would move with difficulty. In the absence of all "slip," or in so small a slip as Mr. Grantham assumed to have taken place in his experiments, the effect of a propeller with an expanding pitch, would be like that of a curved plate, moving through the water in a right line; while the true helix would have acted like a flat plate moving in the direction of its own plane; that is to say, the opposing forces would merely consist of edge resistance and surface friction, which are common to every kind of propeller. The advantage too, which was assumed to arise from this spiral propeller, merely affected the question of magnitude, for it was clear that, whether the screw acted upon a large body of water at once, or gave a second impulse to a lesser quantity, the result would be similar, as to the sum of the effect upon the vessel. It was true that in certain kinds of fish (he would instance the electrical eel,) the impulse produced by the ventral fin, was by an increasing spiral, the length of the curves becoming greater towards the tail; yet it appeared probable, as we could only see this eel in confinement, that the peculiarity he alluded to, was only developed in producing a change from rest to motion, for which it was well adapted, (because the "slip" was great, and the progress small,) and that when in rapid motion, it was probable, that the fin acted in a true spiral.

Mr. Rennie stated that the "slip" of the screw of the Dwarf, was from $\frac{1}{8}$ th to $\frac{1}{9}$ th. That with respect to the general question of the "slip," he conceived that it depended upon the comparative resistance between the vessel and the propeller. The case was similar to the immersed plane surfaces of the paddle-wheels of a steamer, and of the vessel itself; the resistance of the midship section was reduced by the forms given to the fore and after bodies, which gave the vessel what might be termed more "mobility." According to the experiments of Mr. Peter W. Barlow, read before the Royal Society, May 29th,

1834,* the "mobility" of several of her majesty's steamers was found to vary from $\frac{1}{15}$ th, or $\frac{1}{24}$ th, of a plane surface, equivalent to the area of the midship sections; or, in other words, a plane float of one foot square was equivalent to the midship section of the vessel, of which the mobilities were from $\frac{1}{15}$ th to $\frac{1}{24}$ th. There could be no doubt, that the improvements in the forms of the modern vessels, would have produced even less resistance, and he believed that it might now be taken at from $\frac{1}{30}$ th to $\frac{1}{40}$ th, so that, consequently, a less area of float, or propeller, would suffice to overcome the equilibrium, and produce less "slip."

Mr. Smith, of Deanston, observed, that the screw with three blades, which had been used in the Dwarf, seemed calculated to produce the best effect. The opening towards the centre of motion, by reducing the arms of the screw blades, as far as the requisite strength would allow, was judicious, as from the comparative slowness of the rotative motion towards the centre, little propulsive effect was produced; whereas the resistance to onward motion, by the arms, if they had not been reduced, might have been considerable; besides, if the arms were in the part broad, there would have been greater tendency to produce centrifugal action on the water. The gradual alteration of the angle of the blade, to the axis of the screw, or onward path, of the vessel, was also judicious, as it afforded a greater onward action of the blade at the entrance, whilst it gradually curved round to nearly a right angle with the path, so as to leave the water without causing any revulsion; it had thus an action, in some respects, similar to that of the tail of a fish. The salmon, when it "made a run," put down all its side fins, and solely, by the oblique action of the tail, was propelled forward with great force and speed, to which the flexibility and form of the tail, and, more especially, its curving form to accommodate its leaving the water without causing revulsion, principally contributed. Some years ago, Mr. Smith had made experiments with fans for blowing air, and so far as he could recollect, the form of greatest effect, much resembled, in principle, that of the propeller under consideration.

Mr. Farey said, that in order to continue the series given by Mr. Rennie, of steam vessels, which had been recently constructed with screw (or rather oblique acting,) propellers revolving under water, it would be desirable that the meeting should have the particulars of a vessel called the *Napoléon*, which had been built at Havre, by M. Norman, and fitted with engines and machinery constructed in this country by Mr. Barnes. Whilst at Havre, last summer, Mr. Farey had very minutely examined that vessel, and he considered it equal to any thing that had yet been executed of the kind, and a fair specimen of the perfection to which that mode of propelling, had, up to the present time, been brought for sea-going vessels. Mr. Barnes and M. Norman were well known in their respective departments, and they had been accustomed to co-operate during some years past. The engines which had been made and sent by Mr. Barnes to France,

* "An investigation of the Laws which govern the motion of Steam Vessels, deduced from Experiments, by Peter W. Barlow, C. E."—*Philos. Trans.* 1834, p. 309.

and fitted in vessels constructed by M. Norman, had, in most cases, paddle-wheels, with movable, or mechanical, paddles, on the plan introduced by M. Cavé, which possessed a decided advantage over ordinary paddle-wheels; the loss of power occasioned by the paddles entering and leaving the water too obliquely, being much diminished. In comparing the performance of the *Napoleon*, with vessels fitted with those mechanical paddles, there was less effect produced by the oblique acting submersed propeller, when considered merely as a mode of employing a given amount of power, to propel a given vessel through the water in a calm; but if the same power, as the engines of the *Napoleon*, had been applied with mechanical paddle-wheels at the sides of the vessel, (such as Mr. Barnes had been accustomed to construct,) the vessel would have had more speed in calm weather and smooth water, than had been attained by one revolving propeller, with oblique acting blades, applied under water at the stern; and it was possible that a greater amount of speed might have been attained, even with well proportioned common paddle wheels. Nevertheless, the submerged propeller, at the stern, admitted of the use of sails, in concert with steam power, or in lieu of it, (when the wind was strong, and in a tolerably favorable direction,) with much greater advantage than could be done in steam vessels, with the ordinary, or even mechanical, paddle-wheels, although the latter were well adapted for acting in concert with sails, because they would perform well, when the paddles were either deeply, or slightly, immersed. The proper and most advantageous action of ordinary paddle-wheels was very greatly impaired, by variations of immersion; the mechanical paddles, when properly proportioned, were less influenced, and the submerged propeller still less; in fact, being wholly under water, at all times, its action did not appear to be sensibly affected by any such alterations of the depth of its immersion, as were likely to take place in the roughest waves, or the greatest variations of draught. When all circumstances were considered, it might be safely concluded, that vessels fitted with revolving submerged propellers, would answer well for making regular sea voyages, either in winter, or summer; and, on an average, he thought, that their passage would be performed at least as well, if not better, than those of any steam vessels now in use, and with an economy of fuel, arising from such vessels making a more advantageous use of their sails, and less use of their engine power.

M. Norman, in reply to questions from Mr. Rennie, regretted that his slight knowledge of the English language, not only precluded him from fully comprehending the narrative of the paper, and the statements of the several speakers, but also rendered it obligatory that he should communicate to the meeting in French, the few remarks which he could not withhold, after the pressing notice of the chairman. Many experiments had been made in France, with screw propellers, by numerous inventors, as far back as the latter part of the eighteenth century, and by M. Cavé, and others, at recent periods, but the most extensive experiment was that of the *Napoleon*, for which Mr. Barnes had constructed the steam engines and machinery in England, and

which, he might be allowed to say, had given complete satisfaction. The *Napoleon* was built at Havre, and launched at the latter end of 1842, for the service of the French Government Post Office in the Mediterranean. The vessel was built of oak timber, copper fastened and coppered. Its dimensions were as under:—

	Metres.		English. Ft. Ins.
Length of vessel from stem to stern,	47.5	=	155 8
“ at the surface of the water,	45.2	=	148 6
Extreme breadth,	8.5	=	27 8
“ “ at the surface of the water,	8.32	=	27 4
Draught of water when light loaded, abaft,	3.6	=	11 10
“ “ “ “ forward,	2.26	=	7 5
	Sq. Mtrs.		Sq. Ft.
Area of the midship section, at the above draught of water,	13.4	=	144
Area of the surface in contact with the water, occasioning friction,	401	=	4320

The revolving propeller was fixed in a space, or opening, abaft the usual stern-post, (to which, in an ordinary vessel, the rudder would be hung,) and withinside another stern post, which was erected on a prolongation of the keel farther abaft, for sustaining the rudder, so as to leave a space between the two posts, for the reception of the propeller. The centre of the propeller was (1.82 metre =) 6 feet beneath the surface of the waters; its diameter was (2.28 metres =) 7 feet 6 inches, and the highest point of its periphery was 2 feet 3 inches below the water line, when the mean draught of water aft was about 11.82 feet. Four propellers of the same diameter, but of different forms, were made, in cast iron, under the direction of Mr. Barnes, and were tried with various success during the past year. The propellers had been altered several times, and it was found that within certain limits, by cutting away the ends, so as to shorten the length of the screw, (which had also the effect of diminishing the surfaces of the blades,) the speed of the vessel was increased, and the vibration was reduced; a portion of this effect had, however, been attributed to using four arms. A propeller with three blades, occupying the whole of the circle, was first tried; others which presented less central surface answered better, and the best, which was still in use, had four blades, which occupied $\frac{6}{10}$ ths of the area of the circle, when viewed in the direction of the axis, leaving $\frac{4}{10}$ ths of that area vacant, for the free escape of the water between the blades, whose obliquity was such as to produce an advance of (3.12 metres =) 10 feet 3 inches in a revolution. The steam engines were nominally of the power of 65 horses each, = 130 horses together; their cylinders were 45 inches in diameter, their pistons making usually from 27 to 28 double strokes of 3 feet 6 inches in length per minute. The motion was communicated to the propeller by a spur wheel of 126 teeth, working into a pinion of 29 teeth, which gave nearly $4\frac{1}{2}$ revolutions for each stroke of the engine, or about 120 revolutions of the propeller per minute. The ordinary speed of the vessel, without any sails being used, was

10 knots, or $11\frac{1}{2}$ statute miles, per hour. She had three masts of considerable height, the rigging being that of a brig, forward, and that of a schooner at the main and mizen masts, with as great an extent of canvas as would be used in any sailing yacht. When the wind was favorable, and the sails could be used, the speed increased to 11 or 12 knots per hour. After a series of experimental voyages, the vessel had gone to her station in the Mediterranean, where she was now in constant service, and had gone through some rough weather with great success; her motion was described as being remarkably easy, she rolled very little, steered better than ordinary vessels, for the propeller appeared to give increased effect to the rudder, and the propeller had never been observed to show itself above the water, even in the heaviest seas, when the pitching was at its maximum. Figures 5 and 6, are drawings of the Napoleon Screw Propeller.

Fig. 5.

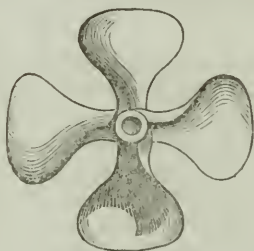


Fig. 6.



Mr. Galloway remarked, that the properties of a screw with an increasing pitch, had been slightly investigated by Tredgold, in his work on the Steam Engine, p. 310, so early as 1827. The author had briefly referred to the subject of screw propellers, and had given some logarithmic calculations of their properties, from which he drew the conclusion, that the true screw could not be carried beyond a single convolution, with any good effect; whereas, by a progressive increase of the pitch, the propelling effort would be continued, until the spiral became expanded into a straight blade parallel to the axis. It was Mr. Galloway's opinion, that more was to be expected from ascertaining the best position for placing the screw, with reference to convenience and effect, than from any slight change in the form, or the number of the blades, or propellers.

Mr. Samuda said it appeared to him, that the action of the propeller tended to drive the water from it at a right angle with its surface, and as it formed a diagonal line with the keel of the vessel, some portion of the force was not efficiently used for propulsion; he conceived, therefore, that by a judicious arrangement of shrouding round the extreme circumference of the propeller, the diagonal currents of the water, might be diverted into a direction parallel with the way of the vessel, and thus cause the whole of the re-action to become available for propelling. Such an arrangement would enable propellers of a much coarser pitch to be employed, and their speed being reduced in proportion, they could be more readily driven directly by the engines, without the intervention of bands, or gearing.

M. Norman said, that M. Cavé had tried a series of experiments on screws of various forms working in cylinders; and also, he believed, with shrouding on their extremities, and he understood that no advantage had been found to result from such modifications.

Mr. Cowper presented an instrument, which he had exhibited when the aerial machine was incidentally mentioned; it consisted of a fan composed of three, or more, blades, set at a regular curve upon an axis. When this axis was placed vertically in a socket, and a rapid rotary action communicated to it, the fan rose in the air to the height of between 100 and 150 feet. On reversing this fan, and using the same propelling force, it would not rise at all. This fact evidently showed that the action of the curved fan upon the air, or of the propeller upon the water, was like that of a screw in a solid, every part of the surface of the blade of a well formed propeller producing its portion of effect. Mr. Cowper directed attention to the contrary effect produced by two fans of similar areas, whose arms were, in the one case, mere planes set at an angle with the axis, and in the other, blades forming part of, and being placed at a given curve around the axis. If it were supposed, that the surface of each blade was divided into a given number of equal parts, when the fan, of the former, or angular, shape, was set in motion, the first part impinging on the air, communicated a movement to it, and the second and succeeding parts, finding no resistance from the disturbed fluid, the body had no tendency to rise; but in the latter, or curved shape, the second and succeeding parts, tended to overtake, and act upon an undisturbed fluid, and thus had a tendency to rise upon an irregular inclined plane, described by its gyration through the air. By the law, that the resistance increased as the square of the velocity, he conceived, that in adapting propellers to vessels, their dimensions should be proportioned, not only to the area of the midship section, but also to the speed of the engine. At the same time, the consideration of the form of the blades was very important. In experiments with the revolving fan instrument, he found, that although, on all occasions, the same rotative force was applied, a fan with three arms, whose united areas were 3.721 inches, when set at a given angle, did not rise freely; the same form and area, when set to a proper curve, rose to a very considerable height; but when a fan of twelve arms, formed from a circle, or disk, of 28.274 inches area, divided into twelve arms, was set in motion, it would not rise at all. With other fans, of intermediate forms, areas, and curves, various results were obtained, which were curious problems for engineers interested in the construction of propellers.

Mr. Grantham expressed his pleasure at finding his paper had so much excited the attention of the meeting, and he hoped it would be followed by communications from members who had devoted more time to the subject; for instance, the numerous experiments made by Mr. Brunel and Mr. Guppy, before deciding on the use of the screw propeller for the *Great Britain*, and those made in the presence of the Government Engineers, Mr. Lloyd and Mr. Murray, on board the *Bee*, the *Rattler*, &c., would be very interesting. Mr. Grantham exhibited a diagram of the propeller used on board the *Liverpool Screw*,

figures 7 and 8, composed of four blades with broad shovel ends, fixed at a mean angle of 45° . This form, although very successful in this

Fig. 7.

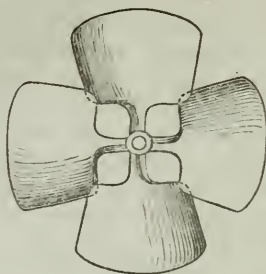
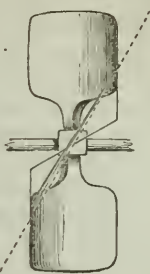


Fig. 8.



case, could not, he thought, be recommended for large diameters. The results of his observations induced him to think, that the blades of a propeller should not be more than four feet apart; he would, therefore, advise the adoption of Ericson's form and mode of construction, which he considered the best that had hitherto been introduced; the ring within the arms permitted any number of blades to be affixed, and a large area of acting surface, judiciously disposed, could thus be obtained. He objected to propellers with three arms, chiefly on account of the small amount of surface obtained. As to the "slip," which Mr. Galloway had so ably commented upon, he was aware that it did exist in all cases, but he was of opinion that the amount was exaggerated; he had not only made accurate experiments with Massey's log, but being repeatedly in a small boat, which was towed close astern of the Liverpool Screw, he found that there was very slight disturbance of the water, and that there was not any depression behind the blade of the propeller on entering the water; this could be easily observed, as a portion of the upper blade was always above the surface. It had been anticipated that this arrangement would, with so short a vessel as the Liverpool Screw, have caused a constant tendency to bear over in one direction, but not the slightest disturbance of the steering was perceived, and the vessel's course seemed to be quite as straight as it would have been with paddle-wheels. Mr. Grantham wished it to be understood, that his object in bringing forward the account of the Liverpool Screw, was not so much to cite that vessel's powers, as to point out the feasibility of working propellers at a slower speed, and that condensing engines could be applied with advantage, avoiding the bands and gearing, which had hitherto been found so objectionable.

Mr. Braithwaite was of opinion that where deep immersion was not practicable, two propellers would be preferable, in order to prevent any disturbance in the steering. Captain Ericson had adopted that plan in boats of light draught. Mr. Braithwaite then presented a drawing of the midship section of the Princeton American frigate, showing the elevation of Ericson's engine on board. The vessel was

164 feet long, with a breadth of beam of 30 feet; the depth of the hold was 22 feet 6 inches, the draught of water was 17 feet 6 inches, and the burthen about 700 tons; the propeller was 14 feet in diameter, with six blades, and made from 32 to 36 revolutions per minute, at which rate the vessel's speed was stated to be nearly 14 miles per hour. The engines were about 400 horses power; they were of peculiar construction, having two steam cylinders, or chests, containing vibrating pistons, or flaps, with cranks upon the ends of the suspending pivots; both these were coupled by connecting rods to a main crank on the driving shaft; the length of these cranks being so proportioned, that their alternate vibrations should give a rotary motion to the main crank, and thus act directly upon the propeller, without the intervention of bands, or gearing.* This principle was tried successfully in the year 1839, by Ericson, on the Thames, in a tug boat named the Robert F. Stockton,† after the projector, who had succeeded in introducing the system to the American navy, and now commanded the Princeton. The boilers of the Princeton were constructed for burning anthracite; the whole of the machinery was so placed as to be out of the reach of shot, and the vessel was ship-rigged, so that by unshipping the screw, she could be rendered as effective as any sailing vessel, with a fair wind, or in case of accident to her machinery. Mr. Braithwaite hoped in a short time to bring before the Institution, an account from Captain Ericson, not only of the Princeton, but of several of the other vessels he had fitted with his engines and propellers, since his residence in the United States. Figs. 9 and 10, are drawings of Ericson's Screw Propeller.

Fig. 9.

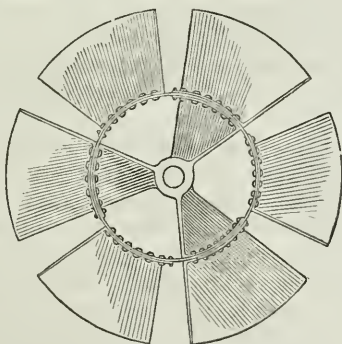
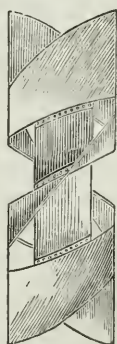


Fig. 10.



Mr. Galloway said, that during the experiments with the Archimedes, a proof had been elicited, that the "following current" had a very considerable effect on the action of the propeller. During one of the trials the vessel was backed astern, when it was found that the speed of the engine increased three, or four, revolutions per minute, while the speed of the vessel appeared to have diminished. This

* Vide Mech. Mag., vol. xxxii, January, 1840, p. 290.

† Vide Mech. Mag., vol. xxx, January, 1839, p. 281.

experiment was, he contended, conclusive as to the fact, that the "slip" was greater than would appear by looking merely at the rate of the vessel compared to that of the screw. He did not, however, think that the "slip" ought to be considerable, with a well constructed propeller. Increased magnitude in a screw would have the same effect in creating resistance, as increased magnitude in any other submerged body. The utility of the increasing pitch, however, was involved in, and solely depended on, the amount of "slip" which would be found to be attended with the least disadvantageous results in other respects; and here Mr. Galloway would observe, that Mr. Cowper's experiments, with the revolving fan instrument, confirmed his view; for it must be recollected, that there the "slip" was much greater than the rate of ascent; the only condition being thus developed in which the utility of an increasing pitch could be contended for. The advantage of turning the propeller by the direct action of the engines, was generally acknowledged. The method of driving it was nearly the only problem remaining for solution, and that difficulty being once overcome, screw propellers must necessarily, from their vast advantage over paddle-wheels, in every respect but that, be universally adopted.

Mr. Hawkins said, that about the year 1825, Mr. Jacob Perkins adapted to the stern of a canal boat, a propeller of about 25 feet in circumference, which might be described as resembling two sets of wind-mill vanes, the solid axle of one set revolving within the hollow axle of the other, the two axles being turned in contrary directions, and the dip of the blades being about half their radius. The propulsive force was stated to have been very effective; the experiments, which were put an end to by the breaking of part of the engine, were never renewed, in consequence of disputes among the patentees; but he considered that propeller as the best that had hitherto come under his notice, and he had endeavored to draw attention to it by reading an account of it, at the meeting of the British Association at Cork, in 1843.

Mr. Grantham stated, that in order to test the comparative effect of the expanding pitch, Mr. Woodcroft had adapted to the stern of a vessel, two screws of equal area, one being of a regular, and the other of an expanding pitch; they were connected by a cross shaft, and were worked by manual power, and it was found that the vessel always yielded to the impulse of the expanding pitch propeller, and was turned by it from the direct course. With respect to the advantage of a large amount of surface, he had found that the action of the propeller of the Liverpool Screw, which had been enlarged three times, was decidedly improved by the alterations; the speed of the engines always remaining the same.

Mr. Galloway said, that the surface of the propeller of the Liverpool Screw, might probably have been too small at first, and, therefore, each increase would naturally improve its effective power. The area of the propeller should be in proportion to the body to be moved; this law was common to screw propellers, and to paddle-wheels.

The President expressed the gratification he felt at the useful discussion, which had been raised on so interesting and novel a subject as the screw propeller, which had become one of such importance in steam navigation, that the government had directed the serious attention of their officers to it; and he trusted that the examination of this question, like that of the action of Cornish engines, at the meetings of the Institution, would materially tend to its elucidation. As soon as any new and really useful invention was matured, and brought sufficiently into use to enable its merits to be calmly discussed, it was one of the main objects of the meetings, to examine it, and he hoped that in a short time a detailed account of the Atmospheric Railway would be submitted by Mr. Samuda, for the consideration of the Institution.

Oxidation of Iron.—Mr. Perkins stated, that on a recent examination of the Napoleon, at Marseilles, the cast-iron of which the propeller was composed, was found to have undergone considerable change, and to have become so soft that it could be cut with a knife.

Mr. Grantham believed, that circumstance was owing to the cast-iron propeller working too near the copper sheathing of the vessel. Iron vessels would not be liable to that objection. The amount of oxidation was apparently increased by the cast-iron remaining in a state of rest; now, as screw propellers were usually in rapid rotation, and were also generally so constructed that they could be unshipped, they could be painted and preserved from any injurious amount of external corrosion, although a chemical change might still be induced when the cast-iron was in contact with copper.

General Pasley had observed, in the metal raised from the wrecks of the Edgar, and the Royal George,* that the cast-iron was generally soft, and, in many instances, resembled plumbago; that when small pieces were cut from any of the iron guns, or that these pieces were pounded in a mortar, heat was evolved, but after two, or three, days the metal cooled again! some of the shot which had been found had burst into several pieces, under this heating action.† The wrought-iron was not so much injured, except when it was in contact with copper, or gun metal; some of it appeared to have undergone an unequal action, and presented a reticulated surface, as if the softer portions had been destroyed, leaving the harder fibres uninjured.‡ Those portions of the wrought-iron which were used by the smiths in the dockyards, were declared to be of a better quality than any modern iron. Neither the copper, nor the gun metal, were much acted upon, unless they were in contact with iron.

Mr. Cottam had observed, with great attention, the iron guns which were brought from the Royal George to the Tower; when they arrived they were soft, and could be easily cut with a knife;|| but when

* The "Edgar" was sunk in 1711, and the "Royal George" in 1782.

† A similar action was observed in the cast-iron shot raised from the "Mary Rose," which was wrecked in the reign of Henry VIII.

‡ This appearance was also noticed by Mr. Mallet, and is mentioned in his paper, "On the Corrosion of Iron, &c."—See *Journal*, vol. vi, p. 386.

|| Vide Trans. Inst. C. E., vol. i, p. 204.

he examined them some time afterwards, the metal had resumed its original hardness. This was frequently the case with pump trees, which had become soft, from immersion in mineral water, but on being taken out and laid aside for a time, they became hard again.

Mr. Galloway stated, that this spontaneous development of heat by cast-iron, which had been long immersed in salt water, had been frequently observed. A striking instance of this kind occurred at Woolwich, when an attempt was made to preserve the copper sheathing of vessels from corrosion. Sir Humphrey Davy suggested to the Admiralty, that the decomposition of the copper sheathing could be neutralized by the application of tin, zinc, or any other easily oxidizable metal; the plan was tried on several vessels, by attaching to them zinc plates, and the protection was so perfect, that the ships' bottoms became covered with barnacles and weeds. Cast-iron was then substituted, on the supposition that the partial oxidation, which would be permitted by the iron, would prevent the fouling of the copper, but that the ordinary rapid destruction would be modified.* The *Magicienne* frigate, having been at sea for some time, with cast-iron protectors, was docked at Woolwich for examination, when it was found that the protection instead of being partial, had been local, for while the greater portion of the surface of the copper was oxidized, as usual, the parts contiguous to the iron had been perfectly protected, and were covered with barnacles. Mr. Marsh (of the Ordnance Department) broke off some small pieces of the iron, which presented the appearance of plumbago, was easily cut, was greasy to the touch, and left black marks on the paper;† in a few minutes the heat became so great as to ignite the paper in which the pieces were enveloped. The development of heat was generally supposed to

* Vide Mr. Wilkinson's paper "On the Sheathing of Ships," see Journal, vol. v, p. 169.

† In Dr. Thomson's "Annals of Philosophy," are the following remarks:—"Dr. Henry states, that 'cast-iron having been in contact with muriate of lime, or muriate of magnesia, most of the iron was removed. The specific gravity was reduced to 2.155, and what remained was chiefly plumbago, and the usual impurities.'

"Dr. Brande found that 'a cast-iron gun had undergone a like change, from being long immersed in sea water. To the depth of an inch it was converted into a substance, having all the external character of plumbago. The component parts were—

Oxide of iron, ... 81

Plumbago, ... 16

97

"Mr. Mushet, in his work on 'Iron and Steel,' states, that wrought-iron sometimes, though very rarely, undergoes the same change.

"Professor Daniel, in the 'Quarterly Journal of Science,' vol. ii, p. 290, says, 'I am inclined, under all the circumstances, to believe that the triple carburet, as it is at first obtained, consists of iron and silicium in the metalline state, united to carbon. When brought into contact with oxygen gas, the metals become converted to protoxides, giving out heat without separating from the carbon.'

"By analysis, he found the substance to consist of

Red oxide of iron, 7.0 = 6.2 black oxide.

4.9 silic.

11.2 carbon.

"The same author states an important fact, bearing on the present question, namely, 'that it took three times as long to saturate an acid, when it acted on white cast-iron, as when it acted on the grey kind.'"

proceed from the rapid absorption of oxygen by the mass, on being brought into the air, from the water, where it had already received a certain amount of oxygen. The production of heat being, in this case, governed by the same law as that under which animal heat, and the heat of combustion, were developed.

Mr. Homersham said, that the water of the Thames, up as high as Richmond, had the same effect as sea water, in rendering cast-iron soft.

Mr. Simpson believed, that if hard grey cast-iron, with a good surface, was used for castings, which were subjected to the action of sea water, but little injurious effect was to be dreaded; he was so convinced of the fact, that he was about to use cast-iron extensively for piles. He had recently examined some cast-iron piles, which had been in sea water for sixteen years, without any detrimental effect being produced.

Mr. Jordan thought, that it was very desirable to mark the difference between the composition of brass, and the alloy of copper and tin, used in casting guns. With brass, in which zinc formed a part of the composition, it was probable that the iron would have been acted upon with less energy, because it was more electro-negative than zinc; but the gun metal acted positively upon the iron, and, apparently, altered the substance.

Mr. Braithwaite said, that the proportions of the mixture, used for the bearings of machinery, were usually 92 per cent. of copper, and 8 per cent. of tin.

The President said, that although the discussion had taken a direction which had not been anticipated, and was foreign to the original subject, he had not attempted to lead it back again, because the question of the causes of the chemical change in cast-iron, in certain positions, and the means of preventing it, was of the utmost importance to engineers, particularly as in all modern works so much cast iron was used.

Civ. Eng. & Arch. Journ.

Proceedings of the Institution of Civil Engineers.—From the London Athenæum.

Breaking of Railway Axles—April 23.—The first paper read was by Mr. C. Geach, who had promised, at a meeting of the Institution, in February, 1843, to give the results of more extended comparative trials of the strength of solid and hollow axles. The result of the present experiments was as decidedly in favor of the solid axle, as the former ones had been in favor of the hollow axle, so that, as far as the practical utility of the examination extended, the results were useless.

A paper was read by Mr. Glynn, relative to the fracture of railway axles, which he attributed to the constant succession of blows received by the axles in travelling. The action was stated to be similar to that of an axle laid on the edge of an anvil, and subjected to a series

of smart blows of a hammer, while in constant rotation. The fracture presented the appearance of a clean annular cleft all round, for the depth of half an inch into the body, the centre part being crystallized, and reduced so much as to be unable to bear the weight and the torsion to which the axle was subjected, by the pressure of the break on one of its ends. These observations had induced the railway company to apply the power of the break upon both wheels simultaneously, thus avoiding the torsional strain.

An account of the Scaffolding used in erecting the Nelson Column, Trafalgar Square, by Mr. T. Grissell, was read. This scaffolding, which was first used in London, for the erection of the facade of the London and Birmingham Railway station, by Messrs. Cubitt, then by Messrs. Grissell & Peto, at the Reform Club House, and also at Woolwich, in forming the new graving dock, was composed of sills, uprights, cross-heads, longitudinal timbers, braces, and struts, all of whole timber. The upright timbers were slightly tenoned into the horizontal timbers, and the junctions secured by iron dogs, driven into the timbers diagonally across the joints, which were preferable to bolts, or spikes, as they could be more easily withdrawn, and the timber was not injured. It was stated, that with this scaffolding, and the traveling machine at its summit, one mason could set as much work in one day as was formerly done in three days by the old system, even with the aid of six laborers, who are now dispensed with. The base of the scaffold was 96 feet square, exclusive of the raking braces; the height of each stage varied from 21 feet to 48 feet; the total quantity of timber used in its erection was 7,700 cubic feet, and its cost was 240*l.* for labor in erecting.

Preserving Timber.—It was recommended that the plan adopted at Liverpool, of bonding timber upon dry land, instead of allowing it to float in timber ponds, should be made use of in London, as, by that means, the timber would be better seasoned, would be less subject to decay, and the Kyanizing process would not be so much required.

Scaffolding employed for the construction and repair of Columns, Obelisks, &c.—A paper, by M. Pierre Journet, described the scaffolding employed by him for the construction and repair of columns, obelisks, and chimneys, of great height, at Paris; and also the machine used for raising building materials, at the Houses of Parliament, the mansions at Albert Gate, Hyde Park, &c. The scaffolding consisted of a simple combination of a number of brackets, fixed at regular distances of about five feet apart vertically, upon girdles of chains and screws, braced tight round the column under repair: upon these brackets the platforms were laid, and, as the workmen proceeded upwards, the lower brackets were alternately raised to the platforms above, where the workmen stood. The progress thus made in forming, and in taking down, a scaffold, was stated to be very rapid, with corresponding economy of time and expense; no poles, or cords, were used, and no waste of material occurred. By these means the obelisk

of Luxor, at Paris, was repaired in a very short time, and at a very small cost. The machine for raising building materials consisted of an endless chain of square open links, the lower end revolving around a driven wheel, and the upper end around a corresponding wheel, fixed upon a scaffold, at the height of the building. The hods, buckets, and baskets were each furnished with a hook, by which they were suspended on the rising side of the chain, and when they arrived at the necessary height, they were taken off by laborers, and carried to the spot where the materials were to be used; when empty they were hung upon the descending side of the chain, and lowered to be again filled. Messrs. Grissell & Peto, who had used these machines, expressed themselves much pleased at the economy they effected, which would induce them to employ them more extensively with engine power, for the erection of the Victoria Tower, at the new Houses of Parliament.

Description of the method employed for repairing a Chimney 120 feet high, at Messrs. Cowper's Cotton Mills, Glasgow, by J. Colthurst, was read—April 30.—The means adopted were thus described: the workman was provided with a broad leather belt, to which was attached a strong spring hook; staple shaped ladder irons, with flat jagged ends, were driven into the joints above each other at intervals of 15 inches apart, by the man standing on them in succession as he ascended, until he reached the top; his safety was secured by fixing the spring hook on the ladder iron immediately opposite his waist, which enabled him to use both his hands when working; a rope was also passed around his waist, and down inside the ladder irons, to support him in case one of the ladder irons broke, or came out; he thus succeeded in removing some ornamental plates of iron which had been loosened by a storm. In descending, the workman took the ladder irons out one after the other, the whole operation being performed in two days and a half; the total cost, including a bonus of 5*l.* to the workman, was only 13*l.*

The first part of a paper by Mr. W. Fairbairn, on the Reduction of the Magnetic Ores of Samakoff, (Turkey) was read. It commenced with reviewing the few attempts which had been made towards improving the methods of treating the richer iron ores of England and of foreign countries; the great English iron makers having restricted themselves to using the lean carbonates of iron, on account of the facilities they offered for working; the great advantages which might have resulted, both in the quantity and quality of the metal, produced from rich ore, have been thus neglected. It is stated that Mr. Ohanes Dadian, an active and enterprising Armenian in the service of the Sublime Porte, brought to this country specimens of magnetic iron ore, and of bituminous coal found in the district of Shamakoff, in Turkey; he had them analyzed at Paris and in England, and found that the ore was nearly a pure oxide of iron, containing about 63 per cent. of metal, that it was free from sulphur, arsenic, and other deleterious matters, and that there was mixed with it about 12 per cent. of siliceous earth. The ore was described as being found in the

form of a fine sand, covering extensive plains, where it had been deposited to the depth of several feet, probably by the action of water on the mountains around, where a similar ore existed in considerable masses. In consequence of the favorable report of the assayists, and acting on the advice of Mr. Fairbairn, Mr. Ohanes Dadian determined to persevere in his projects, and his attention being directed to the process invented by Mr. Clay, for producing malleable iron direct from the ore, as described in a paper read at the Institution of Civil Engineers, February 14th, 1843, he secured that gentleman's services to conduct some experiments, and subsequently engaged him to proceed to Turkey to prosecute the working of the iron ore on an extensive scale. Mr. Clay's report, and that of Mr. Hague, were fully given; they contained details of the various ingenious modes employed to work the ore, which, being in the state of fine sand, either fell unmelted through the fuel into the bottom of the furnace, or was blown out of the top by the force of the blast. At length Mr. Clay, thinking that if the ore could be deoxidized by a previous operation, it would be in a fitter state for fusion in the blast furnace, submitted it to a partial process, as far as causing it to form into lumps; in that form it was easily fused, and produced cast-iron of a peculiarly ductile fluid, and yet strong character, of which specimens were exhibited; the success of this plan was considered so complete, that the preparations were immediately commenced for erecting works in Turkey on a large scale.

The second part of Mr. Fairbairn's paper was read—May 7.—It noticed the remarkable richness and purity of the iron ores of the East, and the superior quality of the Damascus steel, produced from iron made, apparently, in the most primitive manner; it was remarkable, that, up to the present time, there had been but little change in the manner of manufacturing charcoal iron, even in England; this might be accounted for by the small quantity of wood charcoal used for smelting iron; but it appeared that, with the exception of that which was sent into Staffordshire and South Wales, for mingling with the lean ores of the coal measures, but little of the hæmatite, or rich ores of Lancashire, Cumberland, Cornwall, or Devonshire, was used, although in richness and in quality of metal they equalled those of foreign countries. The paper then entered upon the experiments on the transverse strength of the Turkish iron, and also of the iron from other rich ores, presenting the results in a tabular form, mingled with those which had been reported on previous occasions, in the Transactions of the Philosophical Society of Manchester, and in the Reports of the British Association. These tables were arranged so as to afford the means of comparison of the strength and other qualities of various irons, and also for practical purposes, to furnish a guide for selecting such irons as, by proper mixture of the various kinds, would enable unerring results to be arrived at by the founder, when engaged in producing castings for the engineer, the architect, or for various purposes in the arts, or in construction. Simple rules were also given for finding the breaking weight of beams cast from the fifty-two kinds of iron, which had been experimented upon.

Prismatic Colors in Homogeneous Bodies.—A letter was read from Dr. Schafhäutl, drawing attention to some experiments made by Sir David Brewster, on the prismatic colors generated in homogeneous bodies, when pressure was applied to them; these experiments were recorded in the Philosophical Transactions for 1816. They furnished a method of rendering visible, and of measuring the mechanical changes which took place during the compression, dilatation, or bending of transparent bodies. He also stated that the tints produced by polarized light, were correct measures of the compressing and dilating forces, and by employing transparent gums of different elasticities, the change, which occurred in bodies before they were either broken, or crushed, could be ascertained, and that forming models of arches of simple refracting substances, such as gum copal, &c., giving different degrees of roughness to the touching surfaces of the voussoirs, and exposing the model to polarized light, the results of any degree of friction on the joints would be readily observed. It was stated that similar experiments had been tried by M. Bist, at Paris, almost simultaneously with Dr. Brewster, and that, without doubt, this had materially assisted Dr. Robison in his valuable treatise on the strength of materials.

A description of the Iron Dock-Gates at Montrose Harbor, by James Leslie, was then read.—These gates were described in great detail, giving all the dimensions of the several parts, which were fully shown by drawings. The framing was of cast-iron, covered on both sides with wrought-iron plates $\frac{3}{8}$ th in. and $\frac{5}{16}$ th in. thick, riveted on, so as to be water tight, and to render the gates buoyant, and partly to compensate for the weight of metal in them, which was about 87 tons. The gates were 55 feet wide, and 22 feet 6 inches deep, and were entirely composed of iron, except the bottom bars, and the false mitres, which were of oak. The sluice valves were of iron, without any brass on the faces, but the backs were covered with zinc plates, and the bolts had zinc nuts screwed over the iron ones, in order to check the oxidation of the iron, by the galvanic action of the two metals. A general account of Montrose Harbor was given, and it appeared that although there had existed some doubt as to the successful formation of a harbor in such bad ground, being entirely sand and gravel, which stood full of water within a few feet of the surface, the work having been submitted to Mr. Walker, president of the Institution, and having his approval, had been satisfactorily executed, and stood well.

Atmospheric Railway—May 14.—The paper read was an account, by Mr. J. Samuda, of the atmospheric railway; it commenced with the general principles of the system, describing it as a system of working railways, in which the moving power is communicated by means of a continuous pipe, or main, laid between the rails, and divided by valves into suitable lengths for exhaustion; a partial vacuum is formed in the pipe, by air-pumps, worked by machinery, at intervals, along the line. Along the upper side of the main is a continuous aperture, which is covered by a leather valve guarded above and

below with iron plates, hinged on one side to the pipe, and falling into a groove, containing a mixture of wax and tallow on the opposite side, so as to close the aperture. A piston is attached at some distance in front of, and beneath, the leading carriage of the train, and, by means of a packing of leather, fits within the main pipe, so as to be nearly air-tight. When a vacuum is formed in the main, in front of the pistons, and in the direction in which the train is to travel, the air impinging on the other side of the piston, carries it forward with a velocity due to its pressure upon the area of the piston, which, being attached to the leading carriage, carries the train forward with it. The valve which covers the continuous opening along the main, is opened by a frame and wheels, which precede the carriage, and it is closed and sealed down as the train proceeds, by a heater, which slightly melts the wax and tallow as it passes over it. The details of all these parts were then given, and were illustrated by drawings. The paper then proceeded to notice the early attempts at using the pressure of the atmosphere, for conveying goods and passengers, the proposals of Medhurst, in 1810, of Vallance, (of Brighton,) and others. It appeared that the first intentions were to have exhausted cylinders of considerable area, within which the carriages should travel; but as it naturally was objected that the passengers might not approve of this mode of conveyance, through a continuous tunnel, means were devised for connecting the piston within the tube with the carriages traveling upon the rails outside it, and after numerous attempts, Messrs. Clegg and Samuda succeeded in the system described; and which, after being tried for some time imperfectly at Wormwood Scrubs, has been carried out practically on the line from Kingstown to Dalkey, near Dublin, a distance of $1\frac{1}{4}$ mile, up a series of inclines, averaging 1 in 115. It appeared that most of the previous attempts had failed, chiefly because the continuous valve was defective, and that Mr. Clegg suggested the use of wax and tallow, which had proved so successful as a means of hermetically sealing up the opening caused by the passage of each train. The manner of applying the power was then examined, and the adaptation of the electric telegraph, for giving the signals of the time for starting the engines, at periods along the line, was shown. The accumulation of power in the main, from forming a vacuum previously to the arrival of the train, at each division, was shown to be in proportion to the degree of vacuum which was formed. The friction of the various working parts was stated to be very small, and that on the Kingstown and Dalkey line it was scarcely appreciable. The leakage of the valve, &c., was then examined; and it was argued that the power lost by leakage was inversely as the speed of the train—for the faster the piston passed along, the less time the pipe would be under exhaustion, and, consequently, the less time would the leakage exist. Experiments upon the 15-inch main on the Dalkey line, showed that 5 horses power would be required to overcome the leakage of three miles of railway. The system was stated to be peculiarly applicable to such steep inclines as, with locomotive engines, would be called bad gradients, for so long as the steepness of the inclines was not too

great for trains to descend, without the use of the break, no power was lost; and the cost of working was no greater than on a dead level, for the whole of the additional power required to overcome gravity, while ascending the incline, was restored in descending, particularly when the planes were of great length, and at a convenient inclination, in which latter case there would be a slight saving in working an undulating line. The safety from collision between the trains was much argued upon; and it was stated to be impossible for the trains to approach nearer than three miles to each other, unless at the stations especially appointed for the purpose; single lines of railway could, therefore, be worked with safety. The cost of working was then examined, and taking for data the results of the expenses on the Dalkey line, and supposing the system to be adapted to a line of 112 miles long, similar to the London and Birmingham Railway, on which the cost of working, with locomotives, was stated to be

Per train per mile, for haulage,	15 pence.
“ “ for maintenance,	8 $\frac{1}{4}$ “
The cost of working the atmospheric apparatus would be	
Per train per mile, for haulage,	5 $\frac{5}{100}$ pence.
“ “ for maintenance,	5 $\frac{3}{100}$ “

With the additional advantage of traveling at a mean speed of 50 miles per hour, instead of between 20 and 25 miles with the locomotive system.

May 21.—A discussion upon the atmospheric railway was extended to such a length, as to preclude the reading of any papers; but as many points, both of the theory and practice of the system, remained to be examined, it was decided, that the discussion should be renewed at the next meeting, June 4th, after which a report of the proceedings will be given.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

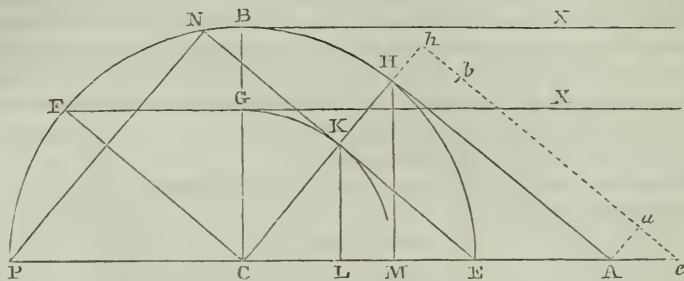
On Long and Short Connecting Rods. By T. W. BAKEWELL.

In the Journal of the Franklin Institute, for April last, page 220, notice was taken of an important error on this subject, contained in a paper copied from a foreign periodical, (the “Civil Eng. and Arch. Journ.,) where it was contended that the force transmitted through the connecting rod, in its own direction, decreased with its decrease of length, in the ratio of the cosines; and that with a short rod greater pressure came on the axis. The gross error respecting the transmission of force, was alone noticed at that time; the increase of pressure by the shorter rod being considered of comparatively slight import, notwithstanding it being said, that “it is the chief thing to be guarded against;” but no statement of the absolute value of this increased pressure is made for a given rod, nor of comparative values for different rods. The fact is admitted of an increase of pressure for friction by a short rod, and it is now proposed to exhibit, in a plain, practical way, what it is worth, carefully keeping in view that

undeviating law, that *sine qua non* in mechanics—"equality of effect" under all modes of action—for, however acute and accurate we may suppose our calculations to be, if they result not according to this law they must be wrong; and we hold the converse of the proposition—equally reliable—if in accordance with it, they must be right.

Let P E, fig. 1, be the length of stroke = 100, the crank B C = 50, then the path of the crank will be P B E = 157.08; now the piston of a rotary engine would describe this path under the constant lever B C = 50, and with a force of $.6366 \times 157.08 = 100$ for effect.

Fig. 1.



The effective length of the crank, or "leverage," is, in all cases, equal to the perpendicular drawn from the direction of the rod to the axis, as G C, where F C, is crank, and F X, rod. The rod B X, or F X, is indefinitely long, so as to preserve its parallelism, in describing the distance of the stroke, in its own direction, = 100, and to give an effect equal to the rotary engine, will require a force of 1. multiplied into its distance, 100. The mean leverage to produce this equal effect under force 1. is 31.83, for the required force is inversely as the leverage, or the distance described. Then we say inversely, if force .6366 be lev. 50, so will force 1. be lev. 31.83, and lev. G C, 31.83 is to lev. B C, 50, as distance P E, is to distance P B E. The crank at F C, is in position for mean effective leverage = G C, 31.83.

The pressure on the axis is with the parallel rod equal 1., or what is required to meet the equal force 1. on the piston, the mean leverage being 31.83, and to increase this pressure on the axis, when using the same crank and length of stroke, we must show a less leverage under a greater force. The foregoing parallel rod X and X, is the longest possible, and the minimum is the length of the crank—and we proceed with nearly the shortest possible, or as rod 60, to crank 50,—for errors, if they exist, are brought out most vividly by extremes.

Rod H A, = 60, perpendicular to the crank, is at its maximum leverage, but at its mean of position and time, in reference to the force transmitted in its own direction, being as the cosines inversely. The mean leverage is proportional to the sines, when rod and crank are at right angles—then as sine B C 50, give lev. 31.83, so will sine H M, give lev. 24.453, or we can draw the cir. arc, as shown by the governing leverage G C = 31.83, and K L, is the mean leverage for rod 60. Leverage 31.83 $\times$ force 1. gives 31.83 for effective lever, and to

make lev. 24.453 equal, requires a force of $1.302 \times \text{lev. } 24.453 = 31.83$. Cosine M A, is 49.095, then inversely, rad. H A 60, is to force 1. as cosine M A 49.095, is to force required $= 1.302$. While it is shown that the increase of force, to the short, makes it equal for effect to the long, leverage—the terms imply that a less distance is due, but under a greater force, although the stroke $= 100$ remains common to both.

We believe the presentation of this point is novel, and the explanation brings with it coinciding proof of what is here advanced. The statement for explanation partakes of the suppositions, but, in effect, is actual and inevitable. When lines are used to represent forces, it is only in the directions of their lengths that they indicate values; H A, may change place parallel with itself, as by the dotted line $h a$, without expressing effect, but instead of being at $h a$, if it be found at $b e$, it will show the exertion of a force in its own direction $= a e$, while passing the horizontal distance A e. In this manner the distance N E $= 76.825$ is attained, during the stroke, equivalent in mean to the direction of the rod H A, under the force due to it of 1.302 for $a e$ A, and N E P, are similar triangles, and $a e : A e :: N E : P E$; and dis. N E $76.825 \times \text{force } 1.302 = 100$ for effect. Dis. N E 76.825 is to dis. P B E 157.08 as lev. K L 24.453 is to lev. B C 50, and P E : N E :: G C : K L.

Fig. 2.

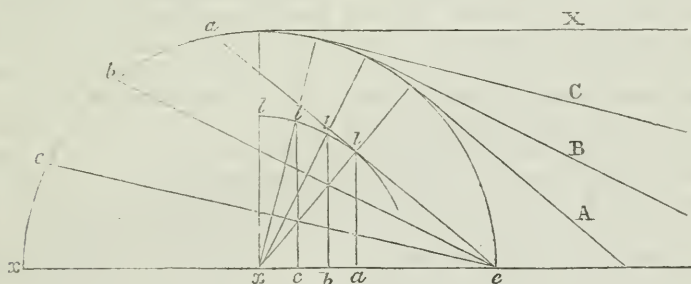


Fig. 2, delineates the relative properties of four connecting rods—in length A 60, B 100, C 200, and X infinite, stroke 100, crank 50, and force on piston 1.—arranged in tabular form, showing the leverage, multiplied by the force, equal the standard leverage 31.83; and that the force, multiplied into the distance, gives, in all cases, equal effect $= 100$:

Rod.	Leverage.	Force.	Equal Lev.	Force.	Dis. of Action.	Effect.
A, $a l = 24.453$	$\times$	1.302	$= 31.83$	$1.302 \times a e = 76.825$	$= 100$	
B, $b l = 28.47$	$\times$	1.118	$= 31.83$	$1.118 \times b e = 89.445$	$= 100$	
C, $c l = 30.88$	$\times$	1.031	$= 31.83$	$1.031 \times c e = 97.$	$= 100$	
X, $x l = 31.83$	$\times$	$1.$	$= 31.83$	$1. \times x e = 100.$	$= 100$	

Accurately, the whole pressure for a given rod is as the leverage inversely, and the extra pressure over the parallel rod, as the difference of the given leverage, and the standard 31.83; but as these are supposed to be unknown quantities, we cannot use them. Therefore

if we take rods B, of once, and C, of twice, the length of stroke, to establish a ratio of extra pressure for friction, we find B is .118 per cent., and C, .031 per cent., which is sufficiently near the convenient ratio of the squares of the rods inversely, to make that the rule for practice. Then say the additional pressure for friction over the parallel, or infinite, rod, is, for once the length of stroke 12 per cent., for twice 3 per cent., and for thrice $1\frac{1}{3}$ per cent.

The value of the pressure for friction is matter of opinion, but if the amount of friction with the parallel rod, exclusive of the piston, and its rod, which are not affected by the changes, be set down of its power at

					15. per cent.
Once,	the stroke will be	12 pr. ct. additional	=	16.80	"
Twice,	"	" 3 "	"	= 15.45	"
Thrice,	"	" $1\frac{1}{3}$ "	"	= 15.20	"

From these data the engineer may see the extent of power sacrificed for the convenience of a short connecting rod, which, we apprehend, is found much less than had been generally supposed.

Cincinnati, 20th June, 1844.

On the Magnesian Limestones. By Mr. C. H. SMITH.

This paper was a continuation of those formerly read, treating on the sandstones and oolites; on the present occasion Mr. Smith proceeded with the subject by describing the great beds of magnesian limestone, which lie, with little intervals, from Nottingham and Tyne-mouth, and more especially those between Mansfield to Knaresborough, an extent of about seventy miles. In this district stone is found combining the carbonate of lime and magnesia from the lowest amount of the latter, to proportions comprising pure dolomite—of course, they vary greatly, both in appearance and quality, and that even in cases when the substances are, chemically speaking, the same:—among the best of these stones, as building materials, are the Bolsover, Roche Abbey, Barnham Moor, and Huddlestone. The first named has been tested in the Norman Church at Southwell, which remains in a state of high preservation; but much, as Mr. Smith particularly insisted upon, depends upon the situation of the beds from which the stone is raised; the remains of Roche Abbey, for example, and the church at Tuxhill, both built with the stone which Sir C. Wren distinguished as second only to Portland, are in a perfect state, with all the sharpness of the mouldings preserved, whereas buildings in the neighborhood erected with the same material during the present century, but without due regard to the choice of the beds, are already in a state of decay; so also with regard to the Barnham Moor stone, many Roman remains at York are in a far better condition than the works of the middle ages in that city, not excepting the cathedral, and others at Hull, Beverly, and Tadcaster, built with the same stone. The Cadeby stone is found to decompose rapidly; a specimen used in London, perished in about fourteen years, and yet this stone is found within a short distance of Conisbo-

rough Castle, which was built with a similar stone from an adjoining hill, and remains the most perfect specimen of masonry of its age existing in this climate. The characteristics of durable magnesian limestone are its compactness, and high crystalization; those which appear earthy, and powdery, and leave white on the fingers, on being handled, are not to be trusted. The Anston quarries, which supply the stone for the Parliament Houses, were left to be the subject of a final communication.—*Trans. Soc. Brit. Arct., April 29.*

London Athenæum.

Light-House for the Island of Bermuda.

The cast-iron light-house for the Jamaica light-house commissioners, which was constructed at Bramah & Robinson's Works, three years ago, under the direction of Mr. Alexander Gordon, induced her Majesty's Treasury to apply to Mr. Gordon, for a still larger light-house for the top of Gibbs' Hill, on the main island of Bermuda, where numerous engineering difficulties have prevented the erection of a light-house in masonry. This work is now visible rising above the houses near the Waterloo Bridge Road; the contractors being Messrs. Cottam for the tower, and Messrs. Wilkison, of Long Acre, for the lantern, and the fitting therein of M. Fresnel's lenticulated apparatus of the first order. The tower is conical; the diameter at the base is 25 feet, tapering to 15 feet at the narrowest part near the top, where it is sponsoned out for the gallery, on which the lantern is to be placed. The total height, from the base to the top of the lightning rod, will be 138 feet, and when erected on Gibbs' Hill, Bermuda, will be 368 feet above the level of the sea, and the light (a fixed light with bright flashes) will be visible all round the dangerous reef of rocks to northward and westward. The outside carcase of the tower is composed of 139 cast-iron plates, their flanches being fixed together by screw-bolts and nuts. There are seven rooms, lighted by port-holes, and ports fitted with plate glass. The rooms are lined with wrought-iron, paneled in oak frames, and the ascent from the bottom to the top is by means of a spiral stair-case of iron, with oak treads. The floors are all of cast-iron, and there is in the centre a hollow column, 16 inches in diameter, for waste water pipes, and for the ascent and descent of whatever may be required in the light room and lantern, or for any of the seven rooms, thus obviating the necessity of carrying any thing up, or down, the stair-case. The whole is constructed with an especial view to the resistance of those terrific hurricanes, and other destroying causes, so common in Bermuda, and some of the West India islands. Being a perfect conductor of electricity, no thunder-storm can effect this structure; being incombustible, it cannot be destroyed by fire. Mr. Gordon's light-house at Jamaica, before mentioned, we described at the time of its temporary erection in this country. It has several times been struck by lightning, which, passing down, exhibited no other effect than the flash reaching the very top of the lightning rod, and has now been lighted for more than two years.

Ibid.

Steam Traction on Canals.

About the end of the last century—at a moment when other men would have been contented with the results obtained—before Bell, or Fulton, had shown the availability of the steam paddle-wheel for navigation, the (great) Duke of Bridgewater made an attempt to substitute the steam-tug for horse-towage on his canal. The following notice, from one of his surviving servants, substantiates this interesting fact:—"I well remember the steam-tug experiment on the canal. It was between 1796 and 1799; Capt. Shanks, R. N., from Deptford, was at Worsley many weeks, preparing it by the duke's own orders, and under his own eye. It was set going, and tried with the coal boats, but it went slowly, and the paddles made sad work with the bottom of the canal, and also threw the water on the bank. The Worsley folks called it *Buonaparte*." It may be presumed that the failure was complete, for no second trial appears to have been made. Eight coal boats were, however, dragged to Manchester, of 25 tons each, at a little more than a mile an hour.

Mechanics' Mag.

Public Works in Paris.

The *National* observes, that it is not without interest to consider the sums expended within the last twenty-four years, in the improvement and embellishment of Paris, which have rendered it one of the finest cities in the world.

	Francs.
Expended on works relative to the distribution of water, aqueducts, reservoirs, and fountains, ...	30,986,347
In flagging and paving, ...	17,644,061
In purchases for enlarging the public avenues, ...	39,047,708
The construction of commercial edifices, as well as in objects of art and decoration, ...	62,984,919
In the purchase of ground necessary for those edifices, ...	17,802,729
Total, ...	168,465,764

Civ. Eng. and Arch. Journ.

ENGLISH PATENTS.

Specification of a Patent granted to J. AINSLIE, of Redheugh, North Britain, for a new and improved mode of drying Tiles, Bricks, Retorts, and such like work, made from clay and other plastic substances.—Sealed Sept. 30, 1843.

The drying of clay formed into tiles and other articles, at the ordinary temperature, and rate of motion of the atmosphere, is a difficult and tedious process at many seasons of the year, so that during the

winter season the manufacture of such articles is either altogether, or in a great measure, suspended. Now it is well known that the drying depends on the rate of evaporation of the water contained in the substances to be dried, that is, on the rate at which the water can be converted into vapor, and, on the removal of the vapor so generated, the former of which depends on the temperature, and the latter on the rate of motion of the surrounding air, or of the current to which the substance to be tried is subject; also, in order to dry any substance with the greatest rapidity, the vapor must be removed as fast as it is formed, so as to prevent the evaporation being checked by the presence of accumulated vapor. Now my invention consists in the application of the above well known truths, or principles, to the manufacture of tiles, bricks, or similar articles, so as to be able to carry on such manufacture at all seasons of the year. For this purpose I place the clay, when formed and ready to place on the shelf to dry, according to the present process of manufacture, in a close chamber, heated to an artificial temperature, and through which a current of air is made to pass by mechanical, or other, means. The chamber which I have hitherto employed is built of bricks, and so situated and arranged that the clay, as taken from the machine, or mould, by which it is formed into the required shape, is placed in a wagon, or frame of shelves, which frame travels along a railway. When the frame is filled, it is run into the close chamber, and left there subject to the artificial current and temperature until the clay is sufficiently dried for burning. The time during which the clay, or plastic, substance must be subjected to the process of drying will depend on the nature and quality of the substance, and on the form into which it is put, and on the temperature and current to which it is subject. I find a temperature of about 80° of Fahr., and a current of about six feet per second, to be a temperature and velocity which answer extremely well for general purposes; but the same may be varied at the convenience of the manufacturer, only taking care not to increase the temperature and current to such an extent that the clay cracks in drying. And if, from the peculiar character, or form, of the clay, the above temperature and rate of current occasion the clay to dry unequally, or to crack, the manufacturer must decrease the temperature and current according to the circumstances of the case, so as to obviate that defect, and allow the clay to dry more slowly. The close chamber, or house, in which the clay is dried may be conveniently adapted to the rate at which the clay can be made into the required forms, so that a frame, or wagon, of dry clay may be removed from one end of the house, or chamber, to the kiln to be burnt, to make room for the introduction of the frame, or wagon, of moist clay at the other end. The close chamber may be heated by flues at the bottom and sides, or by hot water and steam pipes, or by the admission of hot air through small apertures, cold air being let into the chamber at other apertures, so as to mix with and regulate the temperature of the heated air. The warm atmosphere of the chamber may be set in motion by the draught of a chimuey, or fanner, worked by steam, horse, or other power, or the current may be created by injecting, or withdrawing, the air by

pumps worked by power in the usual manner, the mechanical details to be employed for that purpose being well understood, and forming no part of my invention. The close chamber, or house, the method of heating such chamber, and the creation of the current of air through it, and the transfer of the clay to be dried through the close chamber, may be constructed, arranged, and adapted in various ways, according to the circumstances of each case. And I hereby declare that I do not claim the exclusive use of the constructions, arrangements, and adaptations hereinbefore described and referred to, except when the same are used in connexion with, and for the purposes of, my said invention of drying plastic substances in a close chamber, at an artificial temperature, and under a current of air as above described.—
Enrolled March 29, 1844.

Lond. Reper. Pat. Inven.

Specification of a Patent granted to JAMES HARTLEY, of Wear Glass Works, Sunderland, for improvements in the manufacture of Glass.—Sealed July 6, 1843.

My invention relates, Firstly, to an improvement of the furnace used for flattening sheet glass.

Secondly, my invention relates to improvements in the flattening stone used in flattening furnaces.

Thirdly, my invention relates to the application of an improved bed, or surface, for glass when the same is being ground, or polished; and,

Fourthly, my invention relates to an improvement in the furnace used for heating the "nose" of crown glass before "flashing." And in order that the invention may be most fully understood, and readily carried into effect, I will proceed to explain the means pursued by me; and, firstly, in respect to the flattening furnace used for flattening sheet glass, which, being made into cylinders, such cylinders are split, and then flattened, as is well understood. According to the present construction of a flattening furnace, the workman, in flattening successive cylinders of glass in a furnace, as fast as one cylinder is placed on the flattening stone to be flattened, another is placed in the furnace to the right hand of the flattening stone, and as the fire is on the left hand of the flattening stone, as the cylinder on the flattening stone is being flattened, the cylinder of glass next to be operated on is becoming heated, but such heat is chiefly on that side next the flattening stone, that is, the side of the cylinder towards the fire, which, becoming highly heated, will, on that side, begin to drop, or flatten, whilst the other side of the cylinder, that is, the part of the cylinder most distant from the flattening stone, being comparatively little heated, will retain much of its stiffness, and, as the cylinder, on being moved on to the flattening stone, is necessarily moved with its hotter surface towards the fire, that surface will be liable to become burned, whilst sufficient heat is being obtained to the other side of the cylinder, in order to allow of that part being also flattened. Now the ob-

ject of the first part of my invention is to apply a rotary stone, on which the cylinders of glass to be flattened are successively put before going on to the flattening stone, by which the workman, before removing a cylinder on to the flattening stone, may turn it so as to bring the least heated surface towards the fire, so that when on the flattening stone the least heated side may be brought nearest the fire, by which means the side of a glass cylinder, which has become heated during the time that a previous cylinder has been undergoing the flattening process, and which is ready to be flattened, will be turned furthest from the fire, and thus will both parts, or sides, of the cylinder be more conveniently flattened, without one side being liable to become too much heated.

In carrying out this part of the invention at the right of the flattening stone, in the position where the cylinders are usually put preparatory to their being moved on to the flattening stone, I apply a flat circular stone of about ten inches diameter, on the under surface of which I affix an axis, and cause that axis to turn in suitable bearings, so that the workman may readily push the stone round with a cylinder of glass upon it.

It is well known that there is much difficulty in getting sheet glass truly level on the flattening stone, and one of the obstacles is the air which is under the glass. Now the second part of my invention consists in forming numerous small holes through the flattening stone, or bed, so that the air may readily get away from under the glass as the glass becomes more and more flat.

In carrying out this part of my invention, I form holes about an inch apart, each hole being an eighth of an inch, or less, in diameter, which I have found sufficient; but I do not confine myself thereto. By this means I am enabled to perform the process more advantageously; and although sheet glass so flattened is liable to be marked, this is not material, when the glass is to be afterwards ground and polished, and it is of great importance to obtain such thin glass, when to be ground and polished, as flat as may be.

I will now describe the third part of my invention, which relates to the application of an improved bed, or surface, for holding glass when the same is being ground, or polished. In fixing plate and other sheets of glass, in order that the same may be ground and polished, it has been usual to employ plaster of paris, and, in some cases, when grinding and polishing thin sheets of glass capable of bending, other means of holding the same on smooth and unyielding surfaces have been resorted to. Now this third part of my invention consists in applying surfaces of India rubber, on which the plates, or sheets, of glass to be ground, or polished, are to be placed; and owing to the peculiar holding character of India rubber, sheets, or plates, of glass placed thereon, will not be moved by the processes of grinding and polishing the same, whether the glass so treated be plate glass, or sheet glass, and by such means the manufacture of ground and polished plates, or sheets, of glass will be greatly improved.

The processes of grinding and polishing glass being well understood, it will not be necessary for me to enter into any description of the

machinery, or apparatus, and materials used in those processes, and it will only be necessary further to state; that the surfaces of India rubber used should be cut true on the surface which is to receive the glass to be ground, or polished. I use sheet India rubber of about three-eighths of an inch thick, and of a size depending on the size of the sheets, or plates, of glass to be ground, or polished, thereon, and I place such sheets on to a bench, or fixed surface, of wood, or other material; but I do not confine myself to these details, so long as surfaces of India rubber are used for receiving sheets, or plates, of glass to be ground, or polished; and I have found that when the weather is cold, and the surface of India rubber hardened thereby, that the surface should be slightly warmed before a fire, or otherwise.

I will now describe the fourth part of my invention. In the manufacture of crown glass, it is well known that just before introducing the glass into the flashing furnace, the "nose" of the glass is heated at a furnace constructed for that purpose, the opening out of such furnace, where the nose of the glass is applied, being called by the workman the nose-hole, and such furnace is commonly built in at one side of the flashing furnace. The air which causes the rush of flame and heated vapors through the nose-hole, is introduced below the fuel, by which means the draught through the "nose-hole" carries dust and prejudicial vapors into the glass, which is found materially to injure the surfaces thereof. Now this part of my invention consists in so constructing this description of furnace, that air may be introduced above the ignited fuel in the furnace, by which much of the injurious effects of dust, and prejudicial vapors will be prevented coming through the "nose-hole" of the furnace, when heating the "nose" of a glass which is about to be introduced into the flashing furnace. The furnace employed is similar, in all respects, to those now in use, with the addition of means of introducing air in a thin stream, or in several streams, above the ignited fuel in the furnace; and, for this purpose, I construct, on each side of the furnace, a hollow space, which opens into a tunnel from the exterior of the glass-house to admit atmospheric air, but having dampers to regulate the air passing into such hollow spaces, and these hollow spaces ascend, and open into the furnace just above the fuel, so that air will be admitted either in several streams, or in one thin sheet of air inside of the furnace, by which not only will the advantage, above mentioned, be obtained, but a greater heat will result, which can be regulated with facility by the dampers. I would remark, that I am aware that air has been, and is, introduced in various descriptions of furnaces above the ignited fuel therein. I do not, therefore, claim such application of air to furnaces generally, but this part of my invention is confined to the so constructing furnaces of the description herein mentioned, that air may be introduced above the fuel, whereby the manufacture of crown glass will be materially improved.

Having thus described the nature of my invention, and the best means I am acquainted with for performing the same, I would have it understood that I do not confine myself to the precise details, pro-

vided the peculiar character of my invention be retained; but what I claim, is,

Firstly, the improvement of the flattening kiln by the application of a stone capable of rotating horizontally for successively receiving the cylinders of glass to be flattened, before they are moved on to the flattening stone.

Secondly, I claim the employing a flattening stone perforated with numerous holes, as herein described.

Thirdly, I claim the application of India rubber for holding sheets, or plates, of glass to be ground, or polished, as above described; and

Fourthly, I claim the mode herein described of constructing furnaces used for heating the "nose" of crown glass just before introducing the glass into a flashing furnace.—*Enrolled Jan. 6, 1844.*

Ibid.

AMERICAN PATENTS.

Specification of a Patent for an Improved Reverberatory Furnace for converting mineral, or ore, into Wrought-Iron at the first operation. Granted to SIMEON BROADMEADOW, of Manayunk, Pennsylvania, and assigned to Wm. Green, jr., of Woodbridge, New Jersey.—January 20th, 1844.

To all whom it may concern: Be it known, that I, Simeon Broadmeadow, of Manayunk, in the county of Philadelphia, and state of Pennsylvania, have invented a new and improved reverberatory furnace, for the purpose of directly converting mineral, or ores of iron, into wrought-iron, at the first operation, by the process of puddling, using either anthracite, bituminous coal, or other fuel, for that purpose; which furnace I also use for the puddling of pig-iron, or of iron in other states, which is to be submitted to that process, and likewise for the melting, or heating, of metals for various purposes; and I do hereby declare that the following is a full and exact description thereof:—

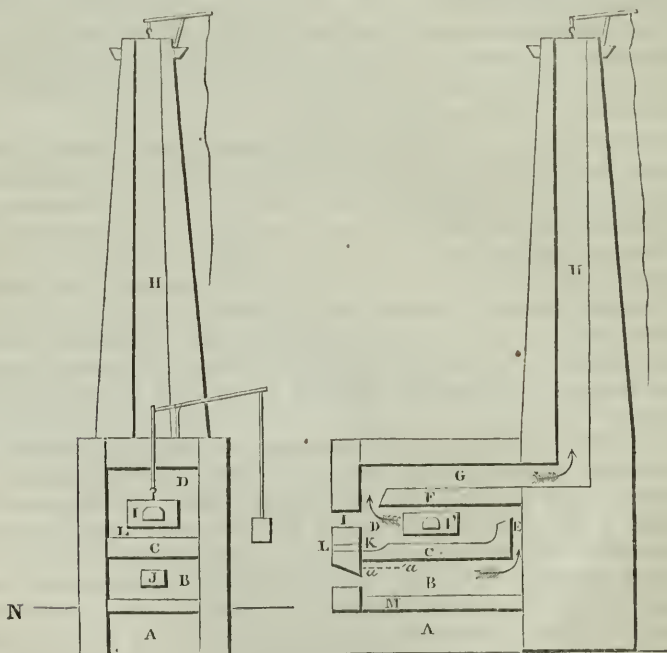
My improvement in the reverberatory, or puddling, furnace, consists in the so constructing it as that the hearth of the furnace shall be heated both on its under and upper sides. For this purpose I construct a fire chamber, in which the fuel rests upon grate bars directly under the hearth of the puddling furnace, there being an ash pit under said grate bars, such fire chamber and ash pit being in the ordinary form. The direct heat of the burning fuel which is contained in the fire chamber, is, consequently, made to operate on the under side of the hearth, and the heated air and flame ascend through a flue space at the rear end of the fire chamber, then along the puddling compartment, to the front of the furnace, and thence back along a flue over the roof thereof leading to the chimney, which is to be elevated in the ordinary manner to create a sufficient draught.

In the accompanying drawing, fig. 1, is a front elevation of the furnace; the masonry which encloses it, and the chimney being

omitted for the purpose of showing the outline of the interior. Fig. 2, is a vertical section through the middle of the furnace from front to back. A, is the ash-pit; B, the fire-chamber; C, the hearth of the puddling furnace D, into which the heated air and flame pass through the flue space E, and operate upon the material within the furnace in the usual manner; F, is the roof of said furnace; the hearth and roof should be formed of suitable fire stone; G, is a flue above the roof, leading to the chimney H; I, represents a front door to the puddling furnace, but the main working door is to be made at the side, as seen at I', this being its usual place; J, is the door of the fire chamber for supplying fuel; K, is a basin at the front of the hearth, and L, a tap hole for the removal of slag, &c.: as it is desirable to keep the hearth at this part well heated, I sometimes so construct the fire chamber as to allow it to project a foot, more, or less, in front of the furnace, by which means this end is effectually accomplished. The lower part of the basin may be strengthened by giving the hearth stone the form shown by the dotted lines *a, a*; M, is the grate, and N, level of the ground.

Fig. 1.

Fig. 2.



Scale, one-eighth of an inch to a foot.

When this furnace is used for the purpose of converting mineral into wrought-iron directly from the ore, said ore is to be finely pulverized, and thrown upon the hearth, which must be heated to whiteness; in about half an hour the mineral will be fused, and it is then to be treated in the same manner as when puddling pig-iron; by this

means the sulphur and other volatile matter contained in the ore will be driven off, and the ore will be subjected to the full action of the heated air. Most kinds of ore may be treated in this way without the addition of any flux, or of carbonaceous matter; but where the ore is refractory, and does not fuse readily, from containing an excess of oxygen, a small portion of charcoal may be added thereto. When the ore is too fusible, owing to its containing an excess of carbon, I add the scales of iron, or some analogous substance, such as the highly oxidized ores, as is sometimes done in the puddling of pig-iron. No rule can be given for this, but the judgment of every competent iron master will supply all the information that is necessary. Most commonly, as before remarked, the metal will be brought into nature without any such addition to the iron. When the mineral, or pig metal, has been thus heated until it approaches the melting point, the fire is to be slackened, until it is reduced nearly to a red heat; in this state the ore, or the metal, is to be worked with a scraper and paddle until the mineral, or metal, shall have become, as the technical phrase is, sufficiently *dry*. At this period the heat is to be raised, and, when the welding of the mineral, or metal, commences, it is to be balled into suitable sizes, either for the hammer, or the rollers.

Having thus fully described the manner in which I construct my puddling furnace, to be used either for the purpose of converting mineral, or ore, directly into the state of malleable, or wrought, iron, as above set forth, or for the puddling of pig metal, or other iron with a like view, and also for the purpose of melting, or heating, of iron, or other metals, what I claim as new, and desire to secure by letters patent, is the constructing and using of a reverberatory furnace that is heated by means of a fire chamber, situated below its hearth, or floor, and from which the flame and heated air are conducted over its top, so as to heat it as well below as above; the respective parts of said furnace being combined, arranged, and operating, as represented and described.

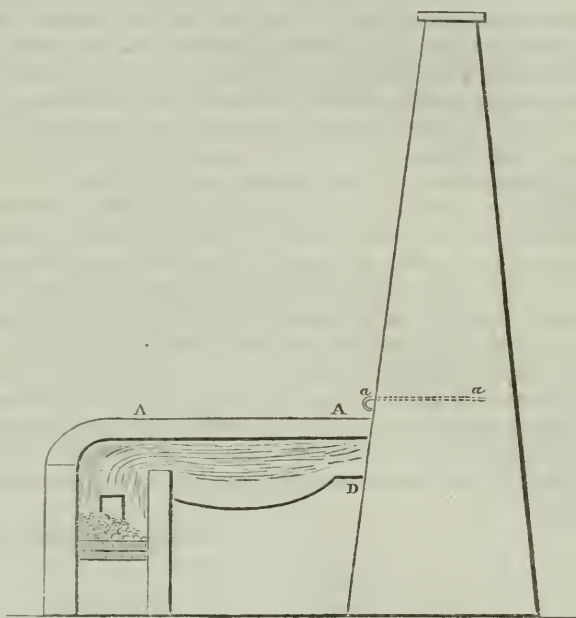
SIMEON BROADMEADOW.

Specification of a Patent for manufacturing Malleable Iron directly from the ore, in a Puddling Furnace. Granted to SIMEON BROADMEADOW, of the city of New York.—May 30th, 1844.

To all whom it may concern: Be it known, that I, Simeon Broadmeadow, of the city of New York, in the State of New York, have invented a new and useful improvement in the process for manufacturing iron; by means of which improvement I am enabled to obtain malleable iron directly from the ore, by treating the same in a puddling furnace; and I do hereby declare that the following is a full and exact description thereof:—

The form that I, in preference, give to my furnace, is somewhat different from that usually given to the puddling furnace, as will be seen by reference to the accompanying drawing, which represents it as having one of its side walls removed for the purpose of showing

the form of the interior. A A, is the arch, or roof, which, instead of curving down as it approaches the chimney, rises regularly from that part which is above the fire chamber, as it approaches the stock, which it may do at an elevation, say of about ten degrees; it may, however, pass horizontally, or even be slightly depressed, without materially interfering with its action; the object of giving to it this form is to prevent its taking the character of a reverberatory, as the reflecting of the flame and heat so as to cause them to reverberate, or impinge, upon the ore, converts the large portion of it into slag, instead of reducing it into malleable iron. I also elevate the hearth of my furnace at its rear end, and prefer to do this to an extent greater than that of the elevation of the roof; this elevation is shown at D.



The object thereof is to contract the throat, or opening, from the furnace into the flue, so as to make it much less than in the ordinary reverberatory, which is usually about two feet, or two feet six inches, whilst I reduce its height, between the floor and the roof, to about one foot. In the lower part of the chimney, as at *a, a*, I place a sliding register, or damper, which I can close at pleasure, so as to retain and regulate the heat; such regulation being essential to the success of my process. In a furnace, so constructed, the mineral, and the metal obtained therefrom, will be sufficiently heated to produce the intended effect; but the form of the furnace may, as above indicated, be varied to a considerable extent without materially interfering with its use; and there have probably been puddling, or other, furnaces constructed, which, under due management, might answer the pur-

pose equally well with that described. I do not intend, therefore, to make any claim to the particular form of the furnace which I have described, but only to indicate the main conditions necessary to the success of the process.

In my process of reducing the mineral to the metallic state, I do not use any of the earthy, or other, fluxes which are employed in the smelting of iron, nor do I, of necessity, mix therewith any carbonaceous matter, as has been uniformly done in the attempts heretofore made to manufacture malleable iron directly from the ore. The most notable of these is the process for which letters patent were obtained in England by W. N. Clay, dated on the 31st of March, 1841, and published in the "Repertory of Patent Inventions," for that year. In that patent a claim is made to "the mode of manufacturing wrought, or malleable, iron in reverberatory furnaces from iron ore, by combining therewith twenty-eight per cent., or upwards, of carbonaceous matter." In my process, on the contrary, I employ the ores of iron alone, by mixing together, in due proportions, such ores as, by their chemical composition, are calculated to react upon each other when duly heated, and to bring the metal contained in each of them into the malleable state, I take any of the ores which are known as oxides of iron, which I reduce to coarse powder, and with this I mix a due proportion of the ore known as a carburet of iron, also in powder; this mixture I put into my puddling furnace, and by means of anthracite, or other fuel, I subject it to the proper degree of heat for effecting the reduction. The mass so placed in the furnace, I do not stir, but leave at rest, until I find that it is brought into a state in which it is prepared for bailing, which condition is produced in consequence of the union of the carbon of the carburet with the oxygen of the oxide, and the consequent production of particles of iron in the malleable state.

When charcoal, or other carbonaceous matter, is mixed with the ore which is to be reduced, the carbon will begin to combine with the iron in the oxide which is to be reduced, before the oxygen of said oxide is so far disengaged as to be ready to combine with it, and the metal will become highly charged with carbon, and the whole contents, will, consequently, be converted into a fluid mass, and this may occur notwithstanding the utmost care on the part of the operator; a very slight deviation in making the mixture, or in the heat to which it is subjected, converting the materials into slag. But when this mixture consists entirely, or nearly so, of the ores to be reduced, as above described, there may be a considerable variation in the temperature without deteriorating the mass, the carbon of the carburet, and the oxygen of the oxide, being given out simultaneously, and these, by their affinity, combining with each other, the iron of both the ores will be left in the metallic state, requiring only to be balled up.

It will be manifest to any one acquainted with the nature of ores, that in mixing them no proportionate quantities can be designated, as scarcely any two ores will be found to be identical in composition; but the proportionate quantities may be learnt from analysis, or will

readily be ascertained by experiment in the hands of a competent iron master.

Although the addition of carbonaceous matter is not necessary in my process of reduction, I do not interdict its use, as it is manifest that a deficient proportion of carburet might find its compensation in such addition, but this would be only a variation of, and not a departure from, the principle upon which I proceed. When the iron is ready for balling, the slag is to be removed, and the balling is to be effected in the ordinary way; the working and feeding doors, the tap hole, and the general appendages of furnaces for this purpose being such as are well known.

Having thus fully set forth the nature of my improvement, in the process for obtaining malleable iron directly from the ores of that metal, what I claim as new therein, and desire to secure by letters patent, is the effecting of such reduction by mixing in due proportion the ores known as oxides, and as carburets of iron, and by exposing them to a proper temperature in a puddling furnace, without the addition of any of the ordinary fluxes, or the necessary admixture of carbonaceous matter therewith.

SIMEON BROADMEADOW.

Specification of a Patent for an improvement in the manufacturing of Steel. Granted to SIMEON BROADMEADOW, of the city of New York.—May 25th, 1844.

To all whom it may concern: Be it known, that I, Simeon Broadmeadow, of the city of New York, in the state of New York, have made a new and useful improvement in the construction of the furnace for converting iron into steel by cementation, and in the process of manufacturing such steel.

In the ordinary mode of constructing the converting furnace, the bars of iron, after being piled in the coffer, or oven, in combination with carbonaceous matter, to the proper height, are covered with a stratum of fire clay and sand, or some analogous substance, which has to be renewed every time the oven is charged. My improvement in the structure consists in the using of a permanent roof of fire stone, or fire brick, in place of the temporary covering heretofore employed. I also use a sliding shutter, which is placed in front of the furnace, so that it may be brought down as required for a purpose to be presently made known.

My improvement in the manufacturing of the steel, after the process of cementation has been completed, consists in the taking of the bars first from the upper part of the convertory, whilst they are at the highest temperature to which they are to be brought, and subjecting them immediately to the action of tilting, or of rolling, without the necessity of re-heating. To do this, a part of the upper layer of bricks which enclose the converting oven is first removed, so as to enable me to draw out the upper bars, and as the bars are successively operated upon, the bricks are further removed, until the whole con-

tents of the convertory have been tilted, or rolled. As this process goes on, the sliding shutter is brought down so as to enclose the part from which the bricks have been removed. By this procedure several advantages are attained in the process of manufacturing steel. Under that hitherto followed, the whole charge has been allowed to cool down before removing the steel from the convertory, and this necessarily resulted in great loss of time; the bars after being removed had to be re-heated, in order to their being tilted, or rolled; by this re-heating time was consumed, and the steel actually injured, it being a well established fact, that every time steel is highly heated, it is deteriorated. The steel manufactured by my improved process, has proved to be very superior to that made from the same iron in the ordinary way; it has, in this particular, exceeded the anticipated benefit.

In the accompanying drawing, fig. 1, is a front view of the converting furnace, the temporary brick work which is used to enclose the coffer, or oven, and likewise those that enclose the flues A, A, the arch B, and the chimney stack C, being removed. D, is the roof of fire stone, or fire clay, which extends over the whole top of the coffer, or oven, E. Fig. 2, shows the top of this roof in plan, being a horizontal section of the furnace, in the line X, X, of fig. 1; D, is the roof stone, and A, A, the flues leading from the fire chamber into the arch, as usual.

Fig. 1.

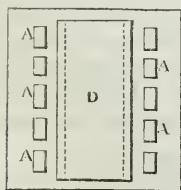
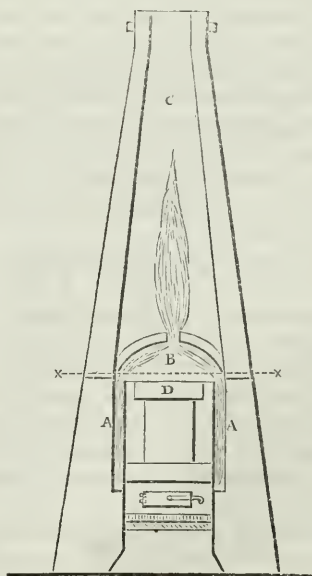


Fig. 2.



Having thus fully described the nature of my improvements in the construction of the furnace for converting iron into steel, by cementation, and also made known my improvement in the process for

manufacturing steel, after the cementation has been completed, what I claim therein as new, and desire to secure by letters patent, is the improvement herein described of taking the steel from the oven in its heated state, and subjecting it to the action of rollers, or of the tilt-hammer, without the necessity of reheating the bars, by which improvement said manufacture is greatly facilitated, and the quality of the steel much improved.

SIMEON BROADMEADOW.

[Specifications written by the Editor.]

MECHANICS, PHYSICS, AND CHEMISTRY.

Extracts from the Report of Capt. G. W. HUGHES, of the Topographical Engineers, to the Secretary of War, relative to the working of Copper Ore.

(Continued from page 43.)

I shall now resume the consideration of the treatment of the mattes at the point where they were ready to undergo the last operation before being refined, viz., *the roasting*. The object of this operation is to separate the most oxidable metals with which the copper is still mixed. The common roasting furnace is used for the purpose, or one that receives a constant stream of air. The last matte obtained, having been run into pigs, is exposed at a red heat to a current of air; the duration of this roasting continues from 12 to 24 hours, according to the lesser, or greater, proportion of foreign metals in the crude copper. The fusion must not take place till the roasting is finished; from the fusion, the copper is run into moulds of sand; the interior of the pigs, thus obtained, exhibit a porous texture, which is caused by the escape of vapor from the moulds. Their surface is covered with black blisters; hence it is called *blistered copper*. In this state it is prepared for the refinery.

When the ores of pyritous copper are very poor, they are calcined, with the view of extracting a portion of the sulphur; and the mass is then lixiviated, for the purpose of dissolving the sulphates of copper and iron formed during the calcinations; old scrap iron is then thrown into the solution, and the sulphate of copper is decomposed, its acid uniting with the iron, which is, at the same time, oxidized, while the copper is precipitated in a spongy metallic state. In this condition it is called *copper of cementation*. From the remaining solution is obtained crystalized sulphate of iron, or the *copperas* of commerce.

Cementation copper is sometimes procured from reservoirs, where the natural solutions of sulphate of copper, which have flowed through subterraneous caverns containing furruginous ores have been collected. The Rio Tinto mine, in Spain, is a notable instance of this mode of obtaining copper. This mine was worked by the Romans, and subsequently by the Arabs and Moors, who, on their expulsion from

Seville, destroyed the works. In 1787, the experiment was tried of extracting copper from its vitriolic waters. The attempt was successful, and from that time to the present, the mine has maintained a great celebrity. It yields annually 1800 quintals* of copper, and consumes 2400 quintals of iron furnished by the iron works of Pedroso. This copper is perfectly pure, and may be employed in alloying the precious metals. The greater portion of it is, however, manufactured at the Seville foundry.

The management of ores of the oxides, or carbonates, of copper is extremely simple. It is, indeed, sufficient to calcine and smelt either of those ores with charcoal, in cupola furnaces, to extract the crude copper.

Dr. Houghton, in his interesting report on the geology of Michigan, states that the carbonates of copper are the predominating ores of that metal found on the southern shores of Lake Superior. The ores from the same region recently exhibited to me by General Cunningham, United States agent of mineral lands, and other gentlemen, consisted of native copper, the red and black oxides, and the hydrosilicate, or *crysocolla*, which, indeed, appears to be the predominating ore. According to Ure, it is green, or bluish green; specific gravity 2.03 to 2.16; scratched by steel; is very brittle; affords water by heating, and blackens; is acted on by acids, and leaves a siliceous residuum. Solution becomes blue with ammonia. Its constituents are silica 26, oxide of copper 50, water 17, carbonic acid 7. When pure, will yield from 40 to 44 per cent. of metal. It is infusible at the blow-pipe alone, but melts readily with borax. This description will apply to the specimens from Lake Superior; but I have never heard of its having been found elsewhere in sufficient quantities to be worked as an ore of copper. I see no reason, however, why it might not be easily reduced, using limestone, or fluete of lime, as a flux. The red oxides shown to me were not very rich, nor were they difficult of reduction. On the whole, I should think they might be worked profitably. The black oxides seemed to be much richer; but I could procure none for experiments.† The predominating ore at Mineral Point, Wisconsin, is the yellow sulphuret, mixed with the *blue carbonate*.

H. C. Strom, State officer of mines in Norway, in drawing a parallel between the British and continental methods of smelting copper, gives the decided preference to the latter, more particularly to that modification of the continental mode practiced in Norway.‡ It appears that at Roros, very accurate experiments have been made, to ascertain the actual expenses of fuel, labor, and transportation, during the smelting operations. At Freyberg, it has been ascertained that the smelting power of *coke*, as compared with *charcoal*, (half pine, half fir,) was in volume as 3 to 1. Taking this as a basis, he says, we may draw the following deductions:—

* The quintal is equal to 112 pounds, or one cwt., English.

† Since writing the above, Gen. Cunningham has kindly furnished me specimens of black oxide of copper, but I have not yet tested them.

‡ The English furnaces are reverberatory, or horizontal; the continental are vertical, or blast, furnaces.

"That one mining ton, 2,352 pounds of pyritous copper ore, averaging, in volume, 19.5 cubic feet, and containing 8 per cent. of pure copper, may be reduced to coarse copper of 85 or 90 per cent. with 38.09 cubic feet of coke, or, in weight, (taking Newcastle coke, of middle size, and allowing 5 per cent. loss,) 1,008.2 pounds."

Mr. Strom supposes that the Norwegian process would require for the calcination of one ton of ore about 350 pounds of coal. He says it appears, by careful analysis, that the slags at Swansea contain from 0.765 to 0.30 pounds more copper, per 100 pounds, than at Roros; and that the difference between the two methods, in loss alone, amounts to 2s. 6d. per ton of ore in favor of the Norwegian. He gives the following estimate of the amount of fuel necessary to reduce a ton of ore to refined copper, viz.:—

	Lbs. of Coal.
The quantity used in calcining, ...	350
1,008.2 pounds of coke, ...	2,016.4*
To this is to be added, for refining, ...	150

Thus the total quantity of coal to reduce a ton of ore, at 8 per cent., to refined copper, by the Norwegian method, would be 2,516.4 pounds of coal, or nearly 107 to 100 of ore.

MM. Dufrenoy and Elie de Beaumont give the following estimate of the expense of making one ton of copper in South Wales:—

12½ tons of ore, yielding 8½ per cent.	£55 0s. 0d.
20 tons of coals, ...	8 0 0
Workmen's wages, rents, repairs, &c., ...	13 0 0
Total, ...	£76 0 0

The "standard" (value) of fine copper varies from £100 to £120 per ton.

Mr. Strom states the excess of coal on the English system, over the continental, at 29 tons per 100 tons of ore; and he estimates the expense of reducing a ton of ore to coarse copper at 11s. 6d., and the refining at 1s. 6d., making in all 13s. The continental method would cost 7s. 2d.; making a difference of 5s. 10d.

He thinks that the principal advantage of the Norwegian process consists in the calcinations; but he also contends that the vertical blast furnace possesses a considerable superiority over the reverberatory furnace; and he suggests that the universal use of the latter in England, is probably owing to the want of water power, and to the fact that the application of coal, or coke, for this purpose is of recent introduction. In conclusion, he observes: "Such being the case, and knowing the reluctance with which alterations were admitted into practice in former days, we may cease to wonder that it has been only within the last fifty years we have acquired the certain conviction that by the continental method a third, and sometimes a greater proportion, of the labor and consumption of fuel incurred in smelting the same ore has been unnecessary, and that no objection has arisen against the use of the reverberatory furnace."

* This corresponds very nearly with the yield of Newcastle coals, but not at all with the Welsh coals, which often produce from 70 to 80 per cent. of coke.

The Refining of Copper.

The process of refining copper is conducted in a reverberatory furnace, the hearth of which is composed of charbonnaile,* or of quartz. The object of this operation is to evaporate all the volatile substances contained in the coarse copper, such as sulphur, arsenic, antimony, &c., and to oxidize and convert into scoriæ the fixed substances, such as iron, lead, &c., in such a manner as to allow the least possible waste of metallic copper. This operation is not very rigorous; but the small portion of gold, or silver, (which it sometimes contains) that will not oxidize is of no injury to the copper.

At the celebrated copper foundry of Seville, in Spain, where the very best quality of metal is produced, the following processes are observed:—

Before heating the blast furnace, whether after its renewal, or the reconstruction of its hearth, the whole interior is plastered with mortar of fire clay, or pulverized brick, for the purpose of closing the cracks, and preserving the vaults from the first impression of the fire.

In arranging the charge, rows of fire brick are placed edgewise on the hearth of the furnace, and on the brick are deposited successive layers of pigs of black, or crude, copper, crossing each other, with sufficient spaces between the pigs to permit the flame to circulate freely through, and amongst the different layers, and to penetrate to the hearth, which it dries and heats sufficiently to produce a gradual fusion of the metal. Care is taken not to obstruct the vent near the flues, and not to place the pigs nearer than five, or six, inches to the walls of the furnace.

The pigs forming the first bed, or layer, are carefully placed, so that they may not, in falling, break up the hearth.

The weight of the charge is proportioned to the capacity of the furnace, and so disposed that the level of the metallic vat, or bath, may be about one inch above the tuyere of the blast; for if it should be higher than this limit, the metal would attach itself to the tuyere, and thus obstruct the blast; and if it should be lower, the current of air would strike the surface of the molten metal imperfectly; in consequence of which the refining process would be much retarded, by leaving the oxidation and volatilization of the foreign substances incomplete.

The judicious management of the fire in a furnace which has been recently repaired, consists in advancing the heat very slowly for the first three hours with very dry wood, to gradually deprive the hearth, or charbonnaile, of its moisture, and to soften the copper, so that it may fuse almost imperceptibly.

If, at the termination of these three hours of heating, it is noticed that the copper has become red, and that the bottom, or hearth, of the furnace has not yet lost its moisture, it will become proper to continue this slow combustion until every part of the furnace has acquired the

* This substance is composed of one-third refractory clay, one-third refractory sand, and one-third pulverized carbon, (in volume;) the whole moistened, and thoroughly worked till it forms a consistent and homogeneous material, which vitrifies into a strong glassy mass by an intense heat.

same temperature with the copper. If, finally, this equilibrium of heat is not observed to take place, it will be necessary to suspend the fire for a short time, and to seal hermetically all the outlets, or fissures, of the furnace, in order to compel the copper to divide with it, its excess of temperature.

When the same degree of heat is thus produced in all parts of the furnace, the blast is forced; and, at the end of seven, or eight, hours, the metal begins to melt, and is soon after covered with a great quantity of scoriæ.

If it should be considered desirable to increase the intensity of the fire, it must be recollected that this object will not be attained by overloading the grates with fuel; otherwise you obtain smoke only, which lowers rather than increases the temperature. The best guide to follow, in this respect, is the flame, which, when there is neither excess nor deficiency of combustible, fills the entire capacity of the furnace, and presents a beautifully intense red appearance.

When the bath has become fluid, and the scoriæ sufficiently liquid to give up the copper which they retained, they are removed with a long handled rabble. If they appear refractory when subjected to a strong blast, they may be brought to a suitable vitrification by mixing limestone, or calcareous clay, with them for a flux. If, on the contrary, they become too fluid to be raked off, which is often the case, they may be thickened by throwing in refractory materials similar to those of which the hearth is composed. After having freed the bath of all impurities, the bellows are put in action.

Soon after the metal is melted, charcoal is ignited in three large iron vessels, lined with loam, to prepare them for the reception of the copper, which is to be converted into rosettes.

Ordinarily, soon after the bellows are put in motion, the evaporation of mineral substances is so abundant as to produce ebullition in the bath; some of the drops rise even to the vault of the furnace, while others escape from the doors, and fall condensed in a drizzling rain of small spherical globules. When this phenomenon appears, the refining goes on well; when it disappears, the operation is drawing to an end.

The most certain indication of the progress of refining is found in a small sample of copper, called a *montre*, which is taken from time to time from the bath on the heated end of a polished steel rod, plunged two, or three, inches deep into the bath, and then immersed in cold water. The *montre* is detached from the rod by a few smart blows of a hammer; and an opinion is formed of the degree of purity it has attained from its density, color, and polish. But these samples are never drawn till the drizzling of metallic globules ceases. The first *montres* withdrawn are thick, the surface is uniform, smooth, and of a red color, resembling old copper coins; the interior is unequal, of a leaden color, and dotted over with white and yellow specks. As the refining process advances, the small holes observed in the first *montre* gradually disappear, the outer surface becomes darker, the inner of a more uniform color, and less and less marked with spots. Finally, when the metal has acquired the greatest degree of purity

that this operation can give, the sample acquires a dark crimson appearance, slightly tinged with a maroon shade; at the same time, the interior is of a deep and uniform red color, unmixed with spots of any kind. In this state, which indicates the greatest possible degree of purity that copper can attain, it is flexible, and its fracture presents a close, soft grained appearance of an obscure red color.

The process must be stopped at the proper time, otherwise a small quantity of oxide of copper would be formed, rendering the metal hard, brittle, and incapable of perfect lamination.

Having ascertained, by an examination of the last montre, that the copper has been sufficiently refined, the action of the bellows is stopped, the opening of the tuyere is closed, the nap is pierced, and the melted copper flows into the vessel, (prepared for its reception,) from which the burning charcoal has been removed. When the receptacles are full, the tap-hole is reclosed with loam. When the surface of the metal (which has been drawn off into the basins,) is covered with a solid crust, it is slightly sprinkled with water, and when about two inches thick is raised up by means of hoops to let the drops drain off, and is then removed from the furnace. This operation is continued till all the copper has been taken off. These layers are called "*rosettes*." They are cooled suddenly by plunging them in water, when they assume a beautiful red color, owing to the removal from their surface of a slight film of oxide of copper, by the volatilization of the water. If the metal should be dipped into water before it has become completely solidified, dangerous explosions may happen; and if left too long cooling in the open air, it becomes peroxidized on the surface, and does not assume those beautiful colors which the protoxide imparts.

Each refining operation produces, in from 14 to 15 hours when the hearth is new, and in from 9 to 10 hours when it is old, $1\frac{7}{10}$ ton of fine copper, with the consumption of $\frac{4}{5}$ th of a ton of dry wood.

Care is taken, after each "drawing off," to close every fissure by which the exterior air might penetrate, in order to produce a gradual cooling of the furnace, and thus to avoid the cracking of the vitrified interior casing which might be caused by a sudden refrigeration.

When it is deemed expedient to renew the hearth, or the interior of the furnace, the old work is broken up, and the materials carefully washed, for the purpose of extracting the little metal which it always contains; small quantities of copper, which have been sublimated, are also extracted from the flues, and other parts of the furnace.

Dr. Ure remarks, that "when a little oxide of antimony and oxide of copper are combined with copper, they occasion the appearance of micaceous scales in the fractured faces. Such metal is hard, brittle, yellowish within, and can be neither laminated nor wire drawn. These defects are not owing to arsenic, as was formerly imagined, but most probably to antimony, or to lead, which is sometimes used in refining copper. They are more easily prevented than remedied. According to Mr. Frèregean, proprietor of the great copper works of Vienne, in Dauphiny, too low a temperature, or too much charcoal gives to the metal a cubical structure, or that of divergent rays; in

either of which states it wants tenacity. Too high a temperature, or too rapid a supply of oxygen gives it a brick-red color, a radiated crystallization without lustre, or a very fine grain of indeterminate form—the last structure being unsuitable for copper that is to be worked under the hammer, or in the rolling press. The form which indicates most tenacity is radiated with minute fibres, glistening in mass. Melted copper will sometimes pass through, successively, these three states in the space of ten minutes.”

The furnaces employed at Seville and Swansea, in the various operations connected with the reduction of copper ores, are all of the reverberatory kind, and may be considered as divided into five species:—

- 1st. Calcining furnaces.
- 2d. Melting furnaces.
- 3d. Roasting furnaces, or “roasters.”
- 4th. Refining furnaces.
- 5th. Heating furnaces, or “heaters.”

Mr. Vivian, the proprietor of the Ha’ford Works, South Wales, has effected many important improvements in the construction of furnaces, amongst which may be mentioned a furnace of three tiers of hearths, which answers the double purpose of calcination and of fusion at the same time—thus very much simplifying these tedious operations. In the roasting furnaces he has succeeded, by an ingenious contrivance, in introducing a continuous current of hot air over the impure metal, by which means oxidation is much facilitated, the smoke is consumed, and the sulphur dissipated.

In the preparation of this paper I have had frequent occasion to regret that the necessity of avoiding the difficulty which always attends the engraving of drawings accompanying executive documents, has often compelled me to render the description of mining operations, furnaces, machinery, &c., much more obscure, and less satisfactory than they might be if accompanied with the usual graphic illustration necessary to present the details of those subjects clearly to the understanding.

At Ha’ford, the refining operation is not widely different from that already described as being practiced at the foundry of Seville.

When the metal is melted, a workman opens the door, and removes with a rake the few scoræ which may float on the surface of the bath. An assay is then taken from the bath with a ladle, and is broken in a vice, when cool, to show the state of the copper. From the appearance of the assay, of the bath, and of the fire, an opinion is formed of the condition of the copper, and of the quantity of dry wood and charcoal which must be added to make it malleable.

When the refining process commences, the copper is brittle, and of a deep purplish red color. Its grain is open, coarse, and rather crystalline.

The metal is next covered over with wood charcoal, and stirred continually with a wooden pole; the gas, or vapor, escaping from the coal produces quite an ebullition. The charcoal is added as often as it may be necessary to keep the metal always covered until the refin-

ing be accomplished, which fact is ascertained by an inspection of the samples frequently taken from the bath. When the grains become very fine, and the assays (half cut through, and then broken,) present a soft, silken fracture, of a fine red color, the process is finished, and the melted copper is removed in *cuvettes*, and run into moulds. The ingots thus formed are about 18 inches long, 12 inches wide, and 2 inches thick.

When the copper is very difficult of refining, lead is added, which acts as a purifier, and assists the oxidation of the iron and other metals which may be present; but it is essential that all the lead itself should be removed by oxidation, otherwise it will hinder the lamination of the copper.

The refining process usually lasts 20 hours. In the first six it undergoes a kind of roasting, and then melts; the next four hours fit it for refining, at which time that operation, in fact, begins, and consumes four hours more; and six hours are required to arrange the mould, to cast the ingots, and to allow the furnace to cool. The charge varies from 3 to 5 tons, and the quantity of fine copper produced at these works per week, is from 40 to 50 tons. According to Mr. Vivian, the consumption of fuel amounts to from 15 to 18 parts of coal to one of refined copper.

Copper of commerce is manufactured into various forms, according to the different objects for which it is intended.

That used in making brass is granulated, for the purpose of presenting a greater surface to the action of the zinc, with which, in this state, it more readily unites. There are two kinds of granulation, the one, of which we have just spoken, is called *bean shot*. It is formed by pouring the melted copper into a ladle, pierced with small holes, and allowing it to fall into a basin of hot water, by which means it is converted into small, smooth, globular grains. If the water is cold, it forms irregular ramified grains called *feathered shot*.

Copper is sometimes run into *ingots*, weighing about six ounces each, intended for the East India market, and is then called *Japan copper*.

The most common form, however, of copper of commerce is that of sheets, into which shape it is brought by rolling the heated ingots between powerful cylindrical rollers. These cylinders are about three feet long by 15 inches diameter, and are so arranged that the distance between the upper and lower rollers may be regulated at pleasure, and adjusted by means of screws to the desired thickness of the metallic plates.

When the copper ingots have been heated to a dull red color, they are removed from the furnace, and passed through the rolls; but they cannot be reduced to sheets without repeated heatings and rollings, because the metal cools rapidly, and acquires, by pressure, a texture which resists further lamination.

The manufacture of copper at all the Swansea works is conducted on essentially the same principles (slightly modified to suit peculiar circumstances,) as those described by Mr. Vivian, in the *Annals of Philosophy*.

The next most important works, after the Ha'ford works, (owned by the Messrs. Vivian,) belong to Williams, Foster & Co. The first thing done is to form a nearly uniform mixture of pulverized ores, as they are unloaded. This is rather important, because the ores being different in constituents and richness, they act often as fluxes for each other. The average yield of these mixtures is about eight and a half per cent.

The ore,* having been thus pulverized, and uniformly mixed, is carried by railway and steam power up to the hoppers, from whence it is passed into the furnaces, (below the hoppers) and there subjected to a high degree of heat for twelve hours, by which time it is well calcined. This drives off much of the arsenic and sulphur with which it is combined. It is then carried to another furnace, where it is melted. The slag is lighter, floats on top, and is the first drawn off. Fluxes are seldom necessary, and never so, except with a very refractory ore, when fluete of lime is used for that purpose. The first slag, which is usually remelted, generally acts as a sufficient flux of itself. It is often seen crystalized in various forms, exhibiting a beautiful pavonine play of colors. The crude copper is now broken up and remelted, with a current of air passing through it, for the purpose of oxidizing the iron with which it is mixed, and is then drawn off into a tank of cold water to granulate. The water is prevented from becoming hot by a cold stream continually running through the tank. The object of the granulation is to separate the metal into small globules, so that the fire may circulate freely through and amongst it, when again subjected to its purifying action. After granulation, it is again roasted, or calcined, for thirty hours, and is then removed to another furnace, when it is melted with a draught of air passing through it, as before, to effect a still further oxidation of the iron; from this furnace it is drawn off and run into pigs. It is then again broken up, remelted, and, in a fluid state, conducted into a refinery among burning charcoal, from whence it is run into ingots, or into plates about 18 inches square by two, or three, inches thick. This is sometimes the copper of commerce; but it is usually rendered malleable and ductile by the following processes, viz., it is clipped, heated, rolled, and cut into sheets, say two feet long; again heated, and rolled; then again heated, *doubled*, and rolled, and sometimes (depending on its quality,) again rolled without additional heating.

This is called finishing. It is then immersed in a bath of uric acid, for the purpose of brightening the metal, and removing the appearance of impurities from the surface. It is then put into a furnace, then immersed in cold water, from which it is brought out bright. It is then taken to a machine, where its four edges are clipped smooth, leaving it about three feet long, one wide, and in thin sheets. It is then assorted, weighed, and stamped with the weight per square foot, which ranges from 10 to 20 ounces.

In some of the establishments the processes are more simple; but I should doubt their being so efficient: as, for instance, the metal is granulated from the first melting direct, and, after the second melting, it is not broken up, but remelted in mass; and, in rendering it mal-

* See first Bulletin of the National Institute, p. 51, Washington, D. C

leable, it is not always submitted to so many heatings and rollings. At Mr. Williams' works an engine of 96 horse power performs the necessary mechanical labor of the establishment. The smoke of all the furnaces is conducted by flues to a large, brick, arched trunk, or common recipient, which leads to a chimney about 70 feet high; this discharges the smoke and noxious vapors, and relieves the workmen from much of their baleful influence.

In the vicinity of the works, and, indeed, for miles round, there is scarcely the appearance of vegetation, and in many places not a trace of it can be seen. Every thing seems to droop and to die under the deleterious influences of the noxious gases emitted from the numerous furnaces; and where the surface of the ground was formerly covered with a rich sward, it is now furrowed by the action of the rains, and little, or nothing, can be made to grow on it. It is alike inimical to animal life. Horses and cattle are poisoned by it; their limbs become swollen; their eyesight defective; their teeth drop out; and they would soon die if they were not removed at the end of two years, when their places are supplied by other victims. It is not so fatal to human beings, as they only *breathe* the arsenic and sulphur, while the poor beasts *eat* those substances from the herbage on which they are deposited; but that it is extremely prejudicial to man, there can be no doubt, although he is certainly less affected by it than one might suppose. I always felt extremely uncomfortable after my visits to the works, and imagined myself pretty well poisoned; and, indeed, how could it well be otherwise, when the presence of arsenic, to say nothing of sulphur, was so perfectly obvious from its alliaceous smell? All suffer from it perceptibly, except the operators, who are so laboriously employed as to excite profuse perspiration, which relieves them, in a great measure, from its injurious action.

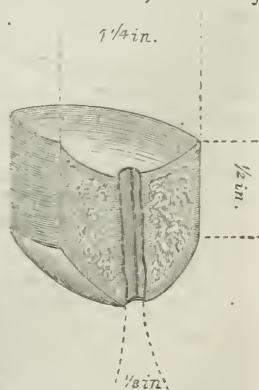
To be Continued.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Explosion of Hardened Steel. By JOHN M. BATCHELDER.

It is well known that dies, and all articles of solid steel, are very liable to become fractured at the edges, if made too hard, but an actual explosion, as detailed below, is, I presume, of rare occurrence. The annexed figure represents a fragment of a step for an upright shaft, made of round steel $1\frac{3}{8}$ inch in diameter, with a hole $\frac{1}{8}$ th of an inch in diameter, passing through the centre.

Twelve pieces were cut from the bar, and after being finished in the usual manner, were tempered separately, each being heated to a cherry-red heat, and plunged in water until perfectly cold; they were then laid aside, where the temperature was at sixty-five degrees. In about an hour, one of them burst



into two parts, with a report as loud as that of a pistol; one of the pieces was thrown about twelve feet, the other struck the wall of the shop two, or three, feet distant. Of the whole number made, eight were broken at intervals of several days, but without any violent explosion. Examined with the microscope, the steel appears distinctly radiated, or fibrous, to the depth of a line from the external surface, while the inside is granular, but without the slightest appearance of flaw, or want of actual contact of the particles at the point ruptured, previous to the explosion. The specific gravity of the bar-steel is 7.825; that of the fractured pieces 7.850.

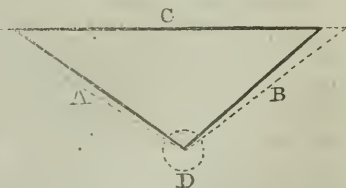
The cause of the fracture is, probably, the same as is observed in the glass toy called Prince Rupert's drops, made by pouring melted glass into cold water; the outside is suddenly contracted, while the particles in the interior, cooling more gradually, assume a different crystalline form, and burst asunder as soon as the cohesion of the external coating is destroyed.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

A Triangular Compensating Pendulum.

The problem of a compensating pendulum, made of a single piece of metal, occupied my attention several years ago: the subject passed from my memory, but was recently revived by looking over some old memoranda—a copy of one of which is subjoined. Besides other objections, an impression that an instrument, like the one proposed, would be of too awkward a shape to be adopted in practice, induced me to lay the project aside. The principle is, however, applicable to other matters; if, therefore, nothing of the kind has been suggested, and the idea be deemed sufficiently novel to be worth recording, you will, perhaps, give it a place in the Journal.

Let the distance from C to D, be the required length of a pendulum, C, being the point of suspension, and D, the oscillating body; it is required that the distance between them shall remain the same under all changes of temperature. Now, instead of directly connecting C, D, by a straight rod, (with the use of which the condition premised is incompatible,) let a triangle be formed as in the figure, of a piece of iron, steel, or other wire, of a uniform thickness and density. It is obvious an increase of heat will lengthen the sides A, B, and tend to thrust D, further from C; but the side C, expanding at the same time, pushes the upper extremities of A, B, wider apart, (as represented by the dotted lines,) and, consequently,—if the length of C, be properly proportioned to A, B,—D, will remain at the same distance from C, as before. Again, suppose A, B, shortened by cold, the length of the pendulum is not effected, because the contraction of the side C, draws A, B, near together, and keeps D, where it was.



Hence it would seem that whatever variations of temperature may take place, such a pendulum, if correctly made, would be invariable. As the compensating property depends on the figure of the rod, no adjusting apparatus would be required. In simplicity, and other qualities, it surpasses the mercurial instrument of Graham, and the grid-iron of Harrison—that is, if the principle be found correct, and no mistakes in the inferences drawn from it. One striking defect, besides that of figure, is the want of stiffness, or rigidity, an important desideratum in a pendulum rod. The spring of the side C, might be fatal. To obviate this, in some measure, that side might be a flat bar, or the whole might be cut out of sheet metal, in which case the edges would oppose less resistance to the air. The position of the instrument, as shown in the figure, might be inverted—D, being made the point of suspension, and the weight placed at C.

Such is the memorandum referred to. If it be found of little worth, as regards the pendulum, it may, possibly, suggest, to some minds, more valuable speculation.

New York, July 5, 1844.

T. E.

New Method of Preventing "Foaming" in Steam Boilers.

Notwithstanding the numerous schemes already before the public, intended to obviate the evils of priming, it would appear that they have not exhausted the remedial appliances within the compass of engineering skill. One mode of combating the evil has, within these few months, been patented by Mr. David Rapier, of Millwall, and another has been secured by registration, by Mr. John Allen, of London. Mr. David Napier's mode consists in covering the surface of the water in the boiler with hollow metallic balls—premising, however, that he does not confine himself exclusively to the use of balls, or to balls which have a less specific gravity than water; for other substances, even pebbles, may be employed, provided they are supported in the interior of the boiler by any mechanical means, as by wire gratings. Wood, he remarks, answers the purpose very well, and hollow glass balls would answer better, were it not that they are too fragile, when there is much ebullition. He, therefore, gives a preference to the metal balls, as they always tend to preserve the level, and present, at the same time, numerous and irregular interstices for the steam to pass through. The effect which the patentee expects to be produced by these balls, is, in the first place, to still the water, so as to prevent its rising up in quantities with the steam; and, in the next place, that the surfaces of the upper tier of balls will serve to intercept the smaller particles of water, and so allow the steam to blow off comparatively dry. Mr. Allen's mode of preventing foaming is different; the apparatus employed is a metal box, perforated with numerous small holes, which is to be attached to the receiving end of each pipe which leads from the boiler of a steam engine into the steam chest, and also to the receiving end of each pipe which leads from the steam chest into the engine cylinder. Both of these plans

appear to us simple and ingenious, and we have no doubts of their efficiency within certain limits. We may also observe that direct foaming is not the only evil encountered. When engines are worked by steam of two atmospheres, and upwards, no inconsiderable portion of the water is carried off with the steam in a state of minute subdivision, but still in the liquid condition; and, as it has no elasticity, and, therefore, produces no good effect, a serious loss of fuel is sustained, amounting, in the case of locomotive engines, on an average, to not less than a fourth of the whole. Any contrivance, therefore, by which this evil might be lessened, is worthy of consideration and fair experiment.

Glasgow Prac. Mech. & Eng. Mag.

Iron Steam Vessels.

A singular calamity has just taken place, which recalls the speculations that endeavored to account for the melancholy fate of the President steamer; and having, unlike that ill fated vessel, left survivors to describe its events, at once gives a probable key to that dreary secret, and should furnish useful warnings for future application to the architecture of steam ships. The Elberfeldt Dutch steam vessel, on her way from Rotterdam to London, has been totally wrecked under novel and remarkable circumstances. "The Elberfeldt sailed from the Brielle on the 22d ult., under light and variable winds. Upon nearing the English coast, Mr. Bushe, a passenger, remarked that the ship's working appeared to be different from when they left Brielle, and that there was a strong vibration of the vessel. Scarcely had these remarks been made, when his suspicions were but too truly confirmed; he begged of Captain Stranach to order the boat to be in readiness, for he was convinced that the vessel, being constructed of iron, would afford but a few minutes to save themselves. While this conversation was taking place, an indication of a plain nature gave warning that their fears were well grounded; for about ten minutes to 3 P. M., she broke completely in half in the middle. Mr. Bushe rushed up stairs, and himself and two others fell headlong into the boat at the moment she was launched. Mr. Bushe then took the rudder of the boat, and kept her head to the wind as she was rowed, stern foremost, towards the vessel to save the remainder of the crew. This was a dreadful moment to all: the wreck presented a most awful, yet grand spectacle; the boiler, bursting by the collapse, threw up immense volumes of steam, and fountains of water, and the vessel went down with a loud explosion. The captain and several others were, with much difficulty, taken into the boat. Three persons were unfortunately lost. Captain Stranach and Mr. Bushe described the whole occurrence as a dream; for, from her breaking to her going down, not more than five minutes elapsed." In reading the story of this instant destruction, wherein the elements had no part, we almost feel as if we had got hold of some authentic narrative by which the mystery of the President was at length solved. Night,

and no survivor, and we have, again, the same wild catastrophe—most probably the same sad and strange tale in all its parts. At any rate, the construction of iron vessels, with their enormous weight of engines, coal, and water, amidships, is a subject which must be forced upon the naval architect; and *should* upon the government, by this direct and authentic evidence; and there are other questions connected with provision for the saving of crews and passengers in cases of shipwreck from other causes, happening to vessels made of iron, which should come, as morals, out of this interesting narrative.

Ibid.

Incrustation of Steam Boilers.

Sir,—I have seen several inquiries in your paper, as to the prevention of incrustation from lime in steam boilers. I am working three steam engines in limestone quarries, and have tried many experiments, having suffered much from this cause. Potatoes are efficacious, but animal matter of any kind much more so. I now use damaged sheep skins, or pelts, which cost me a mere trifle, and answer the purpose very effectually.

R. GREAVES.

Lond. Min. Journ.

List of American Patents which Expired in 1843.

Agriculture, improvements in	P. Pardee, Trenton, N. J.,	Feb. 6.
Anchors, faggoting	Tucker & Judge, Washington, D. C.,	Nov. 19.
Apple paring machine,	R. & A. Mosher, Galway, New York,	Dec. 31.
Apples, fruit, &c., preserving.	A. Hart, Wharton township, Penn.,	Aug. 10.
———, grinding	D. D. Demarest, New Milford, N. Y.,	Jan. 11.
Augurs, hollow	A. Conent, Pepperville, Mass.,	June 11.
——— screw,	D. Bassett, Derby, Conn.,	March 18.
——— ———,	George Shetler, York, Penna.,	Sept. 10.
Axes, making	J. Allen, Sr., Pise, Indiana,	April 9.
Baker, economical	P. Wilcox, Springfield, Mass.,	Feb. 18.
Balance, dormant	J. K. Casey, New York, N. York,	Jan. 21.
Bedstead,	Rogers & Pearson, Essex co., Mass.,	June 11.
——— screw,	J. Copan, New York, N. York,	" 11.
Bell hanging,	J. Russell, " "	Oct. 16.
Bellows for foundries,	W. J. Jacks, " "	April 14.
——— tube,	A. A. McPharin, Huntingdon, Penna.,	June 11.
Bilgeways,	J. Thomas, New York, N. York,	Oct. 10.
Blustock, composition	A. Phillips, Marlboro', Conn.,	" 10.
Blanks for checks, &c.,	J. Atwater, New Haven, Conn.,	Jan. 21.
——— ———,	" " "	Aug. 18.
Boats for canals,	Atwater & Jocelyns, New Haven, Ct.,	June 11.
——— ———,	T. W. Bakewell, Cincinnati, Ohio,	Aug. 25.
Bobbins and flyers,	B. Williams, Hartford, Conn.,	March 3.
Boiler, flat	W. B. Taber, Canton, Mass.,	June 30.
Boilers, &c., for anthracite,	Fanshaw & Hawks, New York, N. York,	" 11.
———, constructing	J. Levatt, Philadelphia, Penn.,	March 17.
Bolting flour, &c.,	J. Hurd, jr., Boston, Mass.,	Nov. 10.
Book-binding,	W. A. Aikens, Berkshire, New York,	Dec. 3.
	J. Torrey, Germantown, Penn.,	Aug. 8.

Boot crimper,	T. Howe, Worcester, Mass.,	June 11.
— manufacture,	A. Burdick, Carroll, N. York,	Oct. 31.
Boots, measuring for, &c.,	T. Howe, Worcester, Mass.,	April 18.
— and shoes, cutting	S. Marshall, Philadelphia, Penn.,	June 23.
—, pegging	N. Leonard, Merrimac, N. Hampshire,	" 11.
—, polished.	Ryan, Haskens & Known, Boston, Mass.,	Sept. 23.
Boxes for machinery,	S. Reynolds, Guildford, New York,	June 13.
Bricks, burning	Adams & Noyes, Newburgh, N. York,	Dec. 28.
Brick machine,	J. S. Hanna, Mercer, Penn.,	Nov. 23.
— press,	J. Woodson, Rockbridge co., Va.,	Sept. 10.
— and tile machine,	J. Wood, Rockland co., N. York,	March 3.
Bridges,	L. Wernwag, Jefferson co., Penn.	Dec. 22.
Brushes, manufacturing	D. Wooster, China, New York,	Sept. 10.
Bulk-heads for steamboats,	R. Whiting, Louisville, Kentucky,	June 6.
Buttons, steel dies for	W. Robinson, Attleboro', Mass.,	March 3.
Canal and other boats,	L. D. Burnet, Butternuts, N. York,	June 30.
— excavating,	G. Hendricks, Urbanna, Ohio,	Aug. 5.
— locks,	J. White, Philadelphia, Penna.,	June 11.
— passages for boats,	J. Bromwell, Cincinnati, Ohio,	" 23.
Carding wool,	J. Baynton, South Coventry, Conn.,	April 11.
Carpeting, felt	A. Byington, Herkimer, New York,	May 6.
—, woolen	W. Harrington, Harrison, New York,	March 3.
—, —	" " "	June 11.
Carriage, double axletree	E. G. Fitch, Blakely, Alabama,	Feb. 7.
— for heavy bodies,	E. Bowen, Ledyard, New York,	April 9.
Carriages, propelling	M. F. Colborn, Baltimore, Maryland,	" 7.
Casks, making, by steam,	J. Thompson, Philadelphia, Penn.,	Dec. 30.
Cement, &c., water-proof	Howe & Haywood, New York, N. York,	Jan. 31.
Chain wheel,	Hines & McCord, Sandy Hill, "	Nov. 20.
Chandeliers of salt,	F. B. Merrill, Buffalo, New York,	June 13.
Charcoal, manufacturing	J. Doolittle, Bennington, Vermont,	Dec. 14.
Cheese curd,	A. Morris, Sacketts Harbor, New York,	May 2.
— press,	R. McOmber, Galway, "	Oct. 27.
Chimnies, cleaning	S. Dow, Elizabethboro', New Jersey,	June 1.
—, curing smoky,	A. H. Reed, Montrose, Penna.,	April 3.
—, iron coping for	E. Neer, Waterford, New York,	Sept. 11.
Churn,	J. C. Barrett, Collins, "	Oct. 19.
—,	W. Cook, South Port, "	Dec. 7.
—,	B. Cushwa, Clear Spring, Maryland,	Jan. 24.
—,	" " "	Dec. 3.
—,	Z. Doty, Groton, New York,	March 17.
—,	C. Foss, Perry, Ohio,	June 11.
—,	H. H. Grover, Auburn, New York,	Nov. 30.
—,	T. & L. Morrison, Groton, "	Oct. 16.
—,	A. Murray, Athens, "	Jan. 27.
—,	S. J. O'Brien, New York, New York,	June 22.
Cider mill,	M. B. Bliss, Pittston, Maine,	April 21.
—,	T. Quintard, Stanton, Conn.,	March 3.
— and press,	U. Emmons, New York, N. York,	Jan. 31.
—,	D. Pride, Potsdam, "	June 11.
—,	D. Reed, Stanton, Conn.,	March 3.
Clay and sand, grinding,	A. Cushman, Sumner, Maine,	" 3.
Clock, self moving,	R. Ward, Waterbury, Conn.,	Nov. 5.
Cloth, cutting	L. P. Lemont, Bath, Maine,	Jan. 9.
—, making	H. Raymond, New York, New York,	June 27.
—, napping	Norris & Phillips, Covington, N. Jersey,	March 22.
—, washing, &c.,	H. Slayton, Lockport, New York,	Nov. 25.
— without bleaching,	Peck & Taylor, Fairfield co., Conn.,	June 27.
Coffee mills,	J. Carrington, Wallingford, Conn.,	Aug. 3.
Combs,	E. Mustin, Philadelphia, Penna.,	June 27.
—, forming, &c.,	S. Lambert, Hanover co., Virginia,	Jan. 19.

Combs, making	E. Sperry, New Haven, Conn.,	Oct. 10.
— manufacture,	J. Brown, Providence, Rhode Island,	June 11.
—, rubbing and polishing	Prindle & Curtis, Newton, Conn.,	Oct. 10.
—, &c., from raw hides,	S. Pike, Providence, Ohio,	June 11.
Commode knobs, glass	E. Skinner, Sandwich, N. Hampshire,	June 11.
Cook, economical	J. Hess, Philadelphia, Penna.,	March 9.
Cooking,	P. A. Sanborn, Troy, New York,	July 11.
Cooper's work, making	N. Rider, Starbridge, Mass.,	April 1.
Corn planting,	Lenox, Croft & Pitner, Steubenville, O.,	Jan. 26.
— sheller,	J. S. Gardiner, Canandigua, N. York,	June 11.
Cotton cleaner,	A. Gillman, Reedy Fork, S. Carolina,	Oct. 10.
— gin,	S. T. Conn, New York, N. York,	Jan. 11.
—, —,	D. Phillips, Jefferson co., Va.,	April 3.
— packing,	O. Stith, Lawrenceville, Va.,	Aug. 25.
— press,	Z. Bronson, Jasper, Georgia,	July 7.
—, —,	P. Payne, Claiborne, co., Mississippi,	Aug. 10.
— seed separator,	F. Follet, Petersburg, Virginia,	Jan. 21.
—, —,	F. Follett, Petersburg, Virginia,	Dec. 16.
— separating,	J. Smith, " "	" 28.
Cradle, self-moving	A. Buckenburger, New York, N. York,	Nov. 3.
Cultivator, tooth	J. Cobb, Westminster, Vermont,	Dec. 7.
Dams, for passage of fish up	P. Magrath, Philadelphia, Penn.,	Oct. 10.
Distillery,	Wm. Cooke, South Port, New York,	Dec. 7.
Distilling, maize	A. Doolittle, Michigan Territory,	Nov. 16.
Dock, dry	E. Seldon, Haddam, Conn.,	July 30.
—, screw	J. C. Ely, New York, N. York,	Jan. 28.
—, —	E. Turner, Rochester, " "	Oct. 10.
Doffer for carding,	C. Alwood, Middletown, Conn.,	April 18.
Door fender,	Cole & Johnson, Rudolph, Mass.,	March 27.
— spring,	L. Burnet, Berlin, Conn.,	Nov. 25.
— and windows, tightening	S. Haywood, Plainfield, Mass.,	Oct. 17.
Drums, soldering factory	L. N. Perry, Worcester, " "	Jan. 23.
Dyeing by steam,	R. Wood, Erie, New York,	Aug. 25.
Fan wheel, thrashing	G. Hoffman, Fredericktown, Md.,	Aug. 21.
Fanning mill,	J. Frary, Southampton, Mass.,	Feb. 17.
Feather cleaning,	C. Toupet, New York, N. York,	Oct. 15.
Felloes, bending, by steam,	M. Blakeslee, Canaan, Conn.,	July 29.
Felt machine,	Baker & Kinsley, Green co., New York,	Aug. 29.
— of wool,	L. Van Hoesen, jr., Norwalk, Conn.,	June 27.
Felting and fulling machine,	Longbury, Arnold & Co., Norwalk, Conn.	July 15.
Files, renewing old	A. P. & E. Brittingham, N. York, N. Y.,	" 27.
Filtering machine,	G. B. White, " " "	" 7.
Fire arms,	H. Rogers, Middletown, Penna.,	May 7.
—, —,	J. Shaw, Philadelphia, " "	" 7.
—, —, discharging	R. Eastman, Brunswick, Maine,	Dec. 7.
Fire and light, producing	J. Jennings, New York, New York,	June 11.
Flax and hemp machine,	Barnum & Stevenson, Cambridge, N. Y.,	July 8.
—, —,	T. Cohoon, Troy, " "	April 25.
—, —,	T. F. L. Roumage, New York, " "	Aug. 6.
—, —,	A. Salesbury, Troy, " "	April 15.
—, —,	Salesbury & Longdon, Troy, " "	" 18.
—, —,	" " " " "	July 8.
—, —,	L. Tibbitt, New Glasgow, Virginia,	Aug. 1.
—, —,	Watson, Blossom & Barnut, Salem, N. Y.,	April 21.
—, —,	R. Medley, Bloomfield, Kentucky,	June 11.
—, —,	A. Glendenning, Loudon co., Virginia,	Sept. 9.
—, —,	H. Korn, Philadelphia, Penn.,	" 12.
—, —,	C. Perkins, Waterbury, Conn.,	Jan. 27.
—, —,	H. B. Chew, Baltimore, Md.,	April 9.
Friction wheels for railroad carriages,	L. V. Badger, Dorer, New Hampshire,	Jan. 30.
Furnace and oven, cooking	J. Hurd, jr., Boston, Mass.,	Nov. 10.
— with reflectors,		

Furrowing machine and corn dropper,	M. & J. Nichols, Otsego, New York,	Oct. 12.
Garments, for cutting	O. Madison, Troy, New York,	Aug. 18.
Gauge for saw sett,	J. Hatch, Westford, Vermont,	Oct. 12.
Glass chimnies for lamps,	J. Jennings, New York, New York,	March 3.
— knobs and screws,	D. Jarvis, Boston, Mass.,	June 13.
— clock wheels,	T. & J. P. Bakewell, Pitsburgh, Penna.,	Jan. 14.
Gold washing,	W. H. Falger, Charlotte, N. Carolina,	Sept. 10.
—, —, —,	" " "	Nov. 18.
—, —, —,	R. Lee, Erwinsville, "	July 8.
Grates, cooking	T. Vinton, Philadelphia, Penna.,	Oct. 31.
Gridiron,	J. Powers, Lansingburg, New York,	Aug. 10.
Grinding grain and paints,	H. Averill, Richland, "	April 30.
Grist mill,	T. Baker, Statesburg, S. Carolina,	Jan. 21.
—, —, —,	M. L. Chase, Frankford, Maine,	Dec. 23.
—, —, —,	B. M. Kemp, Fort Plain, New York,	Jan. 31.
—, —, —,	W. Parkinson, Wheeling, Virginia,	July 31.
—, —, —,	A. Temple, Brookfield, Ohio,	Dec. 11.
Guide boards,	Wickersham & Crozer, East Fairfield,	Aug. 29.
Gun lock,	S. Carter, Raymond, Mass.,	Nov. 25.
—, percussion eight barrel	E. Gilbert, Rochester, New York,	April 3.
Guns, elevating heavy	S. L. Faries, Middletown, Ohio,	Oct. 10.
	W. H. Bell, Fortress Monroe, Virginia,	Dec. 8.
Hammers for nails,	C. A. Strong, South Glastonbury, Conn.,	March 3.
—, hanging forge	J. McNeal, Coleman township, Penna.,	Jan. 21.
Harness, trimmings, &c.	W. S. Robinson, Taunton, Mass.,	Sept. 22.
Harpoon,	J. Sizer, New London, Connecticut,	Oct. 16.
Hat bodies,	Clark & Chase, Falmouth, Mass.,	June 11.
—, —, —,	Lapham & Cady, Canaan, New York,	April 15.
—, —, —,	O. Rust, Montgomery co., "	Dec. 19.
—, —, —,	L. Van Hoeser, Norwich, Conn.,	June 19.
— stiffening,	J. D. Wilson, New York, N. York,	Jan. 6.
Hats, napping	D. Baldwin, Ithaca, "	Oct. 15.
Heater, cylindrical air	C. Fowler, Hartford, Conn.,	July 10.
Heckling, hair, machine	W. Chubb, New York, N. York,	" 9.
Hoes,	G. Freeborn, " "	" 7.
—, —, —,	J. Watson, Canaan, Conn.,	" 26.
House, covering with tin plate, &c.,	R. S. Tilden, Lynchburg, Virginia,	Sept. 10.
Hubs.	H. Thomas, Middleboro', Mass.,	" 11.
Hulling rice and coffee,	Z. Bronson, Jasper, Georgia,	July 7.
Hydrostatic press,	Mason & Baldwin, Philadelphia, Penna.,	Dec. 2.
Ice cutting machine,	N. J. Wyeth, Cambridge, Mass.,	March 18.
—, —, —,	" " "	" 18.
Incline planes for canal boats,	E. Morris, Bloomfield, Penn.,	Oct. 13.
Ink distributor,	J. Prince, New York, N. York,	Dec. 3.
Inking apparatus, gravitating	W. J. Stone, Washington, D. C.,	Oct. 20.
Jackscrow,	T. Evans, New York, N. York,	Feb. 16.
Knife Renovator,	I. Jennings, New York, N. York.	March 17.
— sharpener,	W. J. Dunn, " "	Aug. 18.
—, —, —,	W. Hunt, " "	Feb. 19.
Lamp,	I. Jennings, New York, N. York,	Sept. 10.
Lamps, and economy of light,	" " "	June 11.
—, and ingredients for burning,	" " "	March 3.
Lathe, turning	E. Putnam, Gardiner, Maine,	Dec. 9.
Lecktopography,	J. B. Manning, Gloucester, Mass.,	Feb. 16.
Lever press, compound	J. Rogers, Maury co., Tennessee,	Jan. 21.
Lime, hydraulic	R. Leckie, Washington, D. C.,	March 31.
— kiln,	L. Bomeisler, Philadelphia, Penn.,	Sept. 10.

Locks,	T. Bartholemew, New York, N. York,	April 3.
—, mortise and door	T. Whitehouse, Boston, Mass.,	Sept. 29.
Locomotive for incline planes,	S. Olcott, Harsimus, New Jersey,	" 11.
Loom for figured cloth,	W. Levally, Canterbury, Conn.,	March 20.
Loom, power	A. Stone, Providence, R. Island,	April 30.
Lotteries, drawing	D. Malcolm, New Orleans, Louisiana,	July 30.
Metals and ores, fusing	Chew & Freeman, Baltimore, Md.,	April 7.
Milk, drawing from the breast,	Houghtaling & Maneely, Watervleit, N.Y.	June 11.
Mill, iron	C. & J. W. Post, Washington, D. C.,	April 11.
— machinery, propelling	B. S. Ridgeway, Charleston, S. Carolina,	Feb. 6.
— stone,	D. Phillips, Jefferson co., Miss.,	April 3.
Milling,	J. Reeder, Lebanon, Ohio,	Oct. 31.
Mortising, sawing and boring,	R. Medley, Bloomfield, Kentucky,	July 7.
— and tenoning,	L. Davis, Northampton, Mass.,	April 14.
Mud machine,	J. Newman, Providence, Rhode Island,	June 27.
Mule, self operating	J. Gay, Dunstable, N. Hampshire.	April 10.
Music notes,	W. C. Phillips, Lunenburg, Va.,	June 18.
Muskets, with several charges,	J. Miller, Brighton, New York,	" 11.
Nail machine,	T. Odiorne, Morgan, Mass.,	April 3.
— and rivet manufacture,	S. G. Reynolds, Bristol, R. Island,	" 13.
—, wrought	S. Davis, Dartmouth, Mass.,	Dec. 8.
— and screw machine,	S. Gould, jr., Litchfield, Conn.,	July 25.
Nap on cloth, raising	Z. Allen, Providence, R. Island,	Aug. 10.
Navigation, improvement in	A. Heilbrow, New York, N. Y.,	March 6.
Oil in paint, substitute for	L. J. Van Kleek, Poughkeepsie, N. Y.,	Nov. 23.
—, refining	C. E. Ruggles, New York,	July 20.
Ovens with reflectors,	J. Hurd, jr., Boston, Mass.,	Nov. 10.
Paddle wheels,	J. Perkins, London, England,	Nov. 30.
Packing machine,	T. Jennings, Statesbury, S. Carolina,	March 3.
Paint mill,	S. Cook, Whitestown, N. York,	" 30.
Pan for salt water,	Blockson & Fracker, Zanesville, Ohio,	" 23.
Paper from rags,	J. W. Cooper, Washington township, Pa.,	Feb. 7.
— manufacturing,	R. Fairchild, Trumbull, Conn.,	May 4.
— machine, cylindrical	J. Sanderson, Milton, Mass.,	April 18.
Pegs for shoes,	S. S. & E. Beckwith, Westmorel'd, N.Y.	June 27.
Pencil case, ever pointed	W. Jackson, Philadelphia, Penn.,	July 27.
—, ———	J. Saxton, " "	April 11.
Perambulator,	A. Gifford, West Point, N. York,	Oct. 27.
Pianos, instruments for tuning	P. Pettinos, Philadelphia, Penn.,	March 3.
Picture frames,	Parker & Clover, New York, N. Y.,	" 23.
Plane, groove	Lonanecker & Myers, Lancaster, Penn.,	Feb. 7.
Planing engine, circular	U. Emmons, New York, N. Y.,	Sept. 10.
— and grooving,	C. Taylor, Angola, "	Feb. 7.
— machine, cylindrical	U. Emmons, New York, "	April 25.
Planks, sawing logs into	P. Tomlinson, Derby, Conn.,	" 3.
Planting machine,	Z. Lane, Harrisburg, N. York,	Sept. 21.
Plough,	J. Boatwright, Columbia, S. Carolina,	June 11.
—,	T. Brown, New York, N. York,	Sept. 11.
—,	T. Miller, Pittsburgh, Penn.,	Oct. 23.
—,	J. Rhodes, Urbana, Ohio,	June 11.
—, bogging and ditching	J. Gordon, Copeck, New York,	Jan. 13.
—, cast iron	J. Minturn, Urbana, Ohio,	June 11.
—, double	Medley & Altendeffler, Cootstown, Pa.,	June 11.
—, iron	J. Boynton, South Coventry, Conn.,	July 10.
Power machine,	W. Harford, jr., Washington township, O.,	Dec. 31.
— to machinery,	R. Mitchell, Cynthia, Kentucky,	Oct. 10.
Pressing and raising weights,	T. Cumming, Mayville, N. York,	Feb. 19.
Printing press,	S. Rust, New York,	April 17.

Printing press,	J. J. Wells, Hartford, Conn.,	April 3.
Propelling boats,	B. M. Small, Rochester, N. York,	Nov. 20.
Pump,	J. W. Hillias, Baltimore, Md.,	Sept. 16.
— buckets,	D. Coon, Menden, N. York,	Nov. 28.
Putaps,	R. Wileman, East Hartford, Conn.,	July 9.
— for ships,	J. B. Pell, New York, N. York,	Oct. 31.
—, working ships',	M. Francis, Boston, Mass.,	July 7.
Punch, power press	G. Darracott, " "	July 21.
Rags, cleaning	W. Debit, East Hartford, Conn.,	Jan. 13.
Rail roads and cars,	J. Wright, Columbia, Penna.,	April 17.
— carriages,	J. Knight, Baltimore, Md.,	June 11.
—, improvements in	J. Wright, Columbia, Penn.,	" 11.
Railway carriage,	J. J. Reckert, Baltimore, Md.,	Dec. 11.
—, cylindrical,	J. L. Sullivan, Philadelphia, Penn.,	April 6.
—, self adjusting	P. Flemming, Albany, New York,	May 4.
Razor strops,	H. Finley, Baltimore, Md.,	Oct. 27.
—, rectifying	J. Knight, " "	March 18.
Rectifying spirits by distillation,	J. Wright, Columbia, Pa.,	March 17.
Reeding and fluting, machine for	J. W. Osborne, Terre Haute, Indiana,	Jan. 21.
Rice mill,	G. Halloway, Chester, Ohio,	April 3.
Roofs for buildings,	R. Mauck, Gallipolis, " "	Dec. 7.
Rope making,	J. January, Greenville, Kentucky,	March 3.
Rotary motion by steam,	A. Nourse, Charleston, S. Carolina,	Sept. 3.
— steam engine,	Nathan Adams, Marlboro', N. York,	July 29.
Salt for lye,	S. Hills, jr., Glastonbury, Conn.	June 11.
— manufacture,	J. Mount, Nashville, Tennessee,	July 16.
—, manufacturing,	Lee & Stewart, Philadelphia, Penn.,	June 11.
Sausage machine,	S. H. Bergen, Philadelphia, Penna.,	April 3.
Saw circular, revolving	A. Brown, Salina, N. York,	June 11.
Saws, hanging and straining	T. A. Teissier, Boston, Mass.,	Jan. 13.
Saw mill,	" " "	April 11.
—, floating	E. Wade, Elizabethtown, New Jersey,	June 26.
—, veneering	T. Howe, Spencer, Mass.,	Feb. 19.
Sawing trees,	H. J. Tudor, Boston, Mass.,	April 29.
Scraper, metallic	L. Chapin, Walpole, New Hampshire,	Oct. 13.
Screen, fire	George Brown, Deerfield, N. York,	April 7.
Scythes, rifle for sharpening	J. Johnson, jr., Moriah,	May 7.
Shears, &c., for cloth shearing	J. C. Ely, N. York, " "	Oct. 21.
Shearing, woolen cloth	A. F. Smith, Salem, Mass.,	Sept. 10.
Shingle machine,	D. Pierce, Poughkeepsie, N. York,	April 3.
—, sifting grain, flour, &c.,	O. Teall, Salina, " "	Dec. 9.
—, spade, pronged	C. Pierce, Salem, Mass.,	April 29.
—, spectacles, spiral spring	B. Swift, Washington, New York,	June 11.
—, speeder,	S. A. Britt, Cozanovia, " "	Aug. 10.
—, spikes, bolts, &c., pattern for mould'g	M. Hurd, Augusta, " "	Dec. 7.
—, spinning Silk, Cotton, &c.,	J. Barns, Cornwall Bridge, Conn.,	Oct. 10.
—, hemp, flax, &c.,	J. W. Johnson, Fredonia, New York,	May 7.
—, wool, &c., apparatus for	P. Jones, James City co., Virginia,	Nov. 12.
— and cotton by hand,	R. McOmbre, Galway, New York,	Oct. 10.
Spinner, cap	S. Wood, Holden, Mass.,	Nov. 10.
—, golden	J. D. Woodsides, Washington, D. C.,	March 17.
	J. Nichols, Boston, Mass.,	April 29.
	Wm. B. Horton, Middletown, Conn.,	June 15.
	S. Babcock, Middletown, Conn.,	April 3.
	G. Brewster, Poughkeepsie, N. York,	" 18.
	J. & C. Sewall, Bath, Maine,	March 25.
	G. Addison & L. H. Stearns, N. York, N. Y.,	Oct. 10.
	W. Hunt, " " "	June 11.
	Warren Allen, New Haven, Conn.,	Aug. 15.
	N. Harris, Fairfield co., Ohio,	Jan. 21.
	John Thorp, Providence, R. Island,	" 23.
	J. B. Wheeler, Galway, New York,	Dec. 30.

Spinner, improvement on	J. Thorp, Providence, R. Island,	April 3.
——, running cap	“ “ “	June 13.
Splints for fractured limbs,	D. S. & C. H. Smith, Sutton, Mass.,	Sept. 10.
Spring seats for carriages,	S. Reynolds, New York, N. York,	Nov. 20.
Staging swing,	E. Drury, Washington, Mass.,	Feb. 16.
Stave dressing,	C. B. Goodrich, Rutland, Mass.,	“ 3.
—— dresser,	“ “ “	“ 4.
Steam boilers,	Coffin & Beach, Boston, Mass.,	June 29.
—— engines,	M. Battle, Albany, New York,	Nov. 6.
—— engine, hydraulic	J. Cutlin, Cincinnati, Ohio,	Jan. 11.
——, atmospheric	Mead & Kitchell, Lebanon, Ohio,	Feb. 27.
——, avoiding dead point,	V. Carter, Georgetown, D. C.,	Aug. 3.
——, rotary	J. Woodhull, Rochester, N. York,	April 6.
——, use and application of,	Packard & Strong, Granville, N. York,	Aug. 7.
Steel from wrought iron	S. Pope, New York, N. York,	Nov. 20.
Stereotype plates,	N. Hall, Boston, Mass.,	“ 20.
Steering ships, &c.	M. Pierson, Newburyport, Mass.,	April 1.
Stocks, gentlemen's	G. R. Lillebridge, New York, N. York,	Oct. 10.
Stove, air furnace oven	O. Davidson, Johnstown, “	Aug. 25.
——, cooking	C. Schemerhorn, New York, “	June 23.
——, ——	John Hurd, jr., Boston, Mass.,	Nov. 10.
——, ——	P. Williamson, Philadelphia, Penn.,	Feb. 16.
——, ——	G. Richards, Providence, R. Island,	Sept. 9.
——, ——	W. Naylor, New York, N. Y.,	June 11.
——, ——	A. J. Barnett, Louisville, Kentucky,	Oct. 19.
——, ——	E. E. Bennett, Sandy Hill, New York,	July 17.
——, double furnace	J. Richards, Claremont, N. Hampshire,	Aug. 5.
Straps, punching	Charles Angell, Philadelphia, Penn.,	July 15.
Straw cutter,	L. Rice, Lockport, New York,	April 1.
Sugar breaking machine,	W. G. Sterling, Bridgeport, Conn.,	Jan. 28.
—— from cane juice,	E. A. Lester, Boston, Mass.,	Sept. 10.
Tables for drying tobacco,	G. Campbell, Schenectady, New York,	Jan. 7.
Tanning and tan yard,	L. B. Johnson, Tomkinsville, Kentucky,	March 3.
Teeth, composition for	T. White, St. Clairsville, Ohio,	July 29.
—— extractor,	E. Bryan, New York, N. York,	“ 13.
Temples, rotary	J. Draper, Saugus, Mass.,	April 1.
Tide power,	H. P. Weston, New York, N. York,	Dec. 23.
—— and current mill,	J. Wallace, Hartford, Kentucky,	Sept. 1.
Tin ware,	A. Hubbard, Claremont, N. Hampshire,	Nov. 12.
Thrashing machine,	W. Barnes, Brookhaven, N. York,	Dec. 14.
——, ——	C. Emmons, New York, “	July 27.
——, ——	G. Fuller, Gardiner, Maine,	June 11.
——, ——	E. Harman, Upper Wakefield, Pa.,	Aug. 5.
——, ——	J. Haws, Hudson, N. York,	Dec. 31.
——, ——	T. G. Owen, Baltimore, Maryland,	Nov. 26.
——, ——	J. S. Wood, Botetourt co., Va.,	Jan. 9.
——, ——	J. S. Wood, Pattensburg, “	Sept. 10.
Throstle frames,	H. Ruggles, New York, N. York,	Nov. 24.
—— for spinning cotton,	S. Blydenburg, “ “	“ 10.
Toothache specific,	S. Pennington, Mount Pleasant, Ohio,	July 30.
——, ——	S. Prescott, “ “	“ 30.
Tow lines for canal boats,	James Sandford, Weston, Conn.,	Feb. 16.
Tripp hammer,	S. Kilburn, Sterling, Md.,	Aug. 8.
Truss,	A. G. Hull, New York, N. York,	Oct. 23.
Twine machine,	A. Pond, Petersburg, Virginia,	April 21.
Typography,	W. A. Burt, Detroit, Michigan,	July 25.
Tire hoops, bending	J. Butler, Cobleskill, “	Sept. 24.
Veneers, cutting	C. B. Burnap, Belfast, Maine,	May 1.
——, splitting tenons and	J. McClintic, Chambersburg, Penn.,	April 21.
Veneer and panel cutting	White & Quimby, Belfast, Maine,	Sept. 12.

Wafers, &c., cutting	E. M. Ely, Paris, France,	Jan. 28.
Wagons, raising and lowering	T. Scott, London, Penn.,	March 3
Washing and churning machine,	J. B. Pratt, Milo, New York,	July 14.
_____ ,	F. Reed, Pike township, Penna.,	June 11.
_____ ,	G. B. Gibbs, Le Roysville " "	Oct. 10.
_____ machine,	R. Mosher, Galway, New York,	Jan. 8.
_____ ,	C. D. Wright, East Haddam, Conn.,	Nov. 19.
_____ ,	E. Wheeler, Galway, New York,	June 11.
_____ ,	J. Taylor, Dunstable, N. Hampshire,	April 1.
_____ ,	Schiveler, McEwer & Lindsey, Fredericks-	
_____ ,	burgh, Ohio,	Oct. 21.
_____ ,	W. E. Arnold, Haddam, Conn.,	Aug. 3.
_____ ,	R. Brainard, " "	Nov. 23.
_____ ,	E. Berrey, New York, N. York,	May 12.
_____ ,	E. D. Cherry, Auburn, " "	Sept. 10.
_____ ,	J. T. U. Dennis, Painesville, Ohio,	Dec. 16.
_____ ,	S. Hind, Montrose, Penn.,	April 25.
_____ ,	A. Larcom, Watervleit, New York,	Jan. 16.
_____ ,	P. Mosher, Ballston Spa, " "	Oct. 10.
Water, drawing from forebays, &c.,	Espy & Young, Philadelphia, Penn.,	Sept. 11.
_____ , raising	Lazell & Bloodgood, Poughkeepsie, N.Y.,	July 27.
_____ , _____ , from wells,	S. Smith, Mendon, N. York,	March 17.
_____ , _____ , by atmospheric	S. McClure, Wilmington, Ohio,	Aug. 25.
_____ wheel,	E. Bryan, New York, N. York,	April 8.
_____ wheels, supplying water to	J. Houghton, Greene co., Georgia,	June 13.
_____ for boats and mills,	P. Baynton, Ogdensburgh, N. York,	April 21.
_____ and paddle wheels,	B. Howard, Worcester, Mass.,	June 11.
Weaving narrow stuff,	J. Thorp, Providence, R. Island,	Dec. 22.
Webb of cloth, forming	John Arnold, Norwalk, Conn.,	July 15.
Weighing goods on board of boats,	T. Cohoon, Troy, New York,	June 18.
Wheel, current and tide	A. Madison, Detroit, Michigan,	July 10.
_____ , inside lever propeller,	J. H. Green, Baltimore, Maryland,	Dec. 1.
_____ , _____ ,	J. J. Giraud, " "	" 1.
_____ and rest,	J. Johnson, jr., Moriah, New York,	May 1.
Wheels,	J. G. Bridgman, New Haven, Conn.,	July 16.
White lead,	John Burney, N. Haven township, Ohio,	Jan. 2.
_____ ,	" " " " " "	" 2.
Wind mill,	D. McCollier, Ballston Spa, N. York,	Oct. 10.
Window shutters, securing	T. Bartholemew, N. York, " "	June 30.
Winnowing and threshing machine,	Davis & Carey, Riga, " "	" 11.
Windlass, power	W. Pennell, Brunswick, Maine,	" 29.
Wire nets and fences,	C. Hall, Meriden, Conn.,	Nov. 27.
Wooden combs,	N. Bushnell, Middlesex, Conn.,	April 14.
Wool, &c., manufacturing	J. Goulding, Dedham, Mass.,	Feb. 16.
_____ ,	" " " "	" 16.
_____ ,	" " " "	June 11.
_____ ,	" " " "	July 12.
_____ , spinning	J. Orndoff, Russellville, Kentucky,	Nov. 10.
_____ carding machine,	J. W. Shanklin, Summerfield, Ohio,	May 5.
Yarn, roll on shuttle,	J. Thorp, Providence, Rhode Island,	March 20.

Lunar Occultations.

Lunar Occultations visible in Philadelphia during the month of August, 1844; computed by MRS. CHARLOTTE S. DOWNES, from the Elements published with the Occultation list of the United States Almanac.

The Immersions and Emersions are for Philadelphia, mean astronomical time. Im. for Immersion, Em. for Emersion. These abbreviations in *Italics* refer to those Immersions and Emersions which take place on the Moon's dark limb. N. App. for Near Approach.

The angles are for *inverted image*, or as seen in an astronomical telescope, and reckoned from the Moon's North point and from its Vertex around through East, South, West, to North and Vertex again. For direct vision add 180° .

AUGUST, 1844.

Day.	H'r.	Min.	Star's name.	Mag.	From North.	From Vertex.
1	6	59	Im. 16 Piscium,	6	45°	92°
	8	0	Em.		263	313
1	13	15	Im. <i>m</i> Piscium,	6	350	218
	13	45	Em.		305	324
9	14	41	Im. 15 Geminorum,	6	113	164
	15	34	Em.		245	299
15	11	51	Im. 24 Ophinchii,	6.7	102	53
	12	45	Em.		246	193
23	9	8	Im. 33 Sagittarii,	6	120	112
	10	7	Em.		213	193
23	11	31	Im. ζ^1 Sagittarii,	6	42	9
	12	6	Em.		282	243
23	11	21	Im. ζ^2 Sagittarii,	6	127	95
	11	59	Em.		196	158
26	11	8	Im. c^1 Aquarii,	6	43	14
	12	25	Em.		256	239
28	12	20	Im. κ^1 Piscium,	5.6	43	52
	13	40	Em.		251	235
28	12	19	Im. κ^2 Piscium,	5.6	81	90
	13	35	Em.		213	202

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CIVIL ENGINEERING.

Remarks on the Screw Propeller.

From the Glasgow Mechanic and Engineer's Magazine.

The question of efficiency of the screw propeller, as compared with the ordinary paddle-wheel system of propulsion, is rapidly approaching a practical determination. We do not, however, in the meantime, intend to enter upon a discussion of the particular experiments, complete and in progress; but to examine the subject in its general features, with intention to place it in a proper point of view for subsequent reference.

With regard to the mere effect of the screw, the notices which have from time to time appeared in our pages, making ample allowance for the enthusiasm which naturally associates itself with accounts of the success of new schemes, prove undeniably, that the screw, as a propeller, may fairly be put in comparison with the paddle-wheel; both are found to propel a vessel at a fair speed, and, therefore, the question to be determined, is the balance of advantages possessed by the respective modes of accomplishing the same object.

In any mode of propelling, there is a certain loss of power incurred. The resistance offered by the water to the floats of a paddle-wheel, the thread of a screw of any form, or propelling surface of any kind, or character, is not perfect; there is a certain amount of yield, or recession, of the water, recognized as *slip*; and in this, there is, of necessity, a corresponding loss of power. To express this circumstance less technically, when a paddle-wheel is made to act upon the water, the vessel does not advance through the corresponding space

through which the power is exerted, but passes over a distance considerably less. Commonly, indeed, the useful effect measured in distance passed over by the vessel does not exceed three-fourths of the entire space passed over by the paddles, and frequently the difference amounts to as much as one-third of the whole power expended.

To determine the amount of slip, theoretically, for any given mode of propelling, would lead to calculations much too complicated to be useful; but the amount of experience derived from the working of paddle-wheels of almost every conceivable form and proportion, enables us to approximate very nearly to the amount of power to be allowed in that mode of propelling; and from the logs of twenty-three steam vessels now before us, we may state that the speed of the paddles being 1000, that of the vessel will be very nearly expressed by 739. We have not the same precise knowledge with respect to the slip of the screw, for, independently of experience being limited to comparatively a few instances, the data furnished are less precise, and, therefore, less to be depended on. But making use of such information as we possess, it appears that the difference of efficiency of the two modes of propelling, as respects slip, is not a matter of serious importance. Referring to the Archimedes, from which our most circumstantial information is derived, it appears that the screw is 5 feet 9 inches diameter, with a pitch of 8 feet, the area of the acting surface considered as a disk of the same diameter, acting in the direction of the axis of the vessel, is, therefore, about 26 feet, without deducting the section of the shaft and bearing. The area of the midship section is stated to be 122 square feet; consequently, the ratio of the propelling surface to the area of midship section is as 1 to 4.7, which, it will be observed, is a small proportion of propelling surface compared with the area of paddle-floats usually immersed in steam vessels. Now, in a number of well attested and independent trials, it appears that the average rate of the vessel, compared with that of the screw, is in the ratio of 100 to 129; that is, the power expended is to the useful effect, as 100 to 77.4, or, calling the space passed through by the screw 100, the distance over which the vessel was propelled is expressed by 77.4.

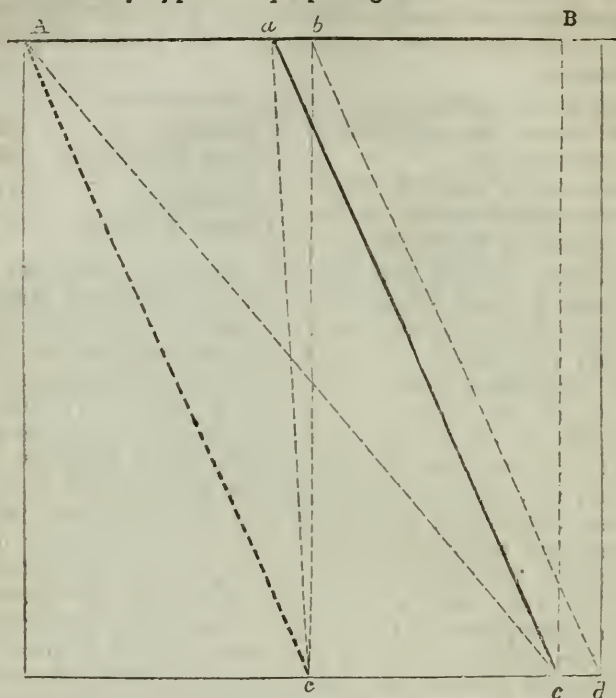
From this it would appear, that the slip is actually less than the average deduced from trials with the paddle-wheel; but, it must be observed, that the average ratio, formerly stated, is deduced from logs of vessels of which we know little beyond their actual rates of sailing, nominal power of engines, and number of strokes; and upon which we observe a difference in respect of their speed and expenditure of power equal to 18 per cent. of the whole power employed. And, further, if we bear in mind that the Archimedes is built to good, though not superior, lines, we must be prepared to compare the action of its propeller with a particular case in which we can ascertain, as nearly as may be, the same data. Possibly, the example of the Great Western may be more generally known than any other, and the data ascertained are very precise. As respects the average immersion of her floats, the average amount may be taken at 180 square feet perpendicular surface; and her average midship section is pretty

nearly 460 square feet. The ratio of the propelling surface to that of the section, is, therefore, as 1 to 2.56—which, it will be observed, is greatly more than the ratio of these quantities in the Archimedes. Now, in the Great Western, the average speed of the vessel compared with that of the paddles, is pretty accurately ascertained to be very nearly as 100 to 127—that is, the power consumed being 100, the effect produced, measured by the distance passed over, is expressed by 78.7. The comparison between the two vessels will, therefore, stand thus:—

Area of the midship section being expressed by 1.			
The area of the propelling surface in the	{	Archimedes is	0.203
		Great Western is	0.391
Difference of speed of vessel and propeller—that is the amount of slip in the	{	Archimedes	0.291
		Great Western	0.271

It, therefore, appears, that while the amount of propelling surface in the Great Western is very nearly double that of the Archimedes, compared with the midship sections of the two vessels, the amount of slip is only very slightly less; and, compared with several other vessels, the Archimedes seems superior, as respects the action of its propeller, in the application of the motive power. To account, in some degree, for this result, which could hardly be expected *a priori*, it must be observed, that the action of the screw upon the water is not merely an oblique action, tending to give a rotary movement to the water, rather than to impel it directly backwards. Moreover, the commotion caused by its action in the fluid, is greatly less than that caused by the ordinary paddle-wheel, in which no inconsiderable amount of power must be consumed in beating the surface of the water, in consequence of the oblique action of the float boards. As regards the oblique action of the screw, it will at once be perceived, that the amount will depend upon the pitch and velocity conjointly. It does not depend upon the pitch alone—for the screw being itself carried forward with the vessel—the angle of the inclined plane, formed by the thread, is proportionally diminished as respects its action upon the water. This becomes self evident, if we assume that the vessel with the screw advances through a space equal to the whole pitch of the screw; in this case, it is manifest, that the screw would not *strike* the water, but simply glide through it, and there would be no slip. To ascertain, therefore, the angle at which the water is impelled by the screw, we must take into account the velocity of the vessel, and the amount of slip, or recession, of the water. This may be represented to the eye by such a diagram as that subjoined, in which if A B, represent the direction of motion of the vessel, and A *a*, the distance through which it is advanced by one revolution of the screw, then, it is clear, that the angular position of the thread A *c*, is virtually changed in respect to its action on the water to that of the dotted diagonal line *a c*. The amount of motion given to the water—that is, the amount of slip—is indicated by the dotted position *b d*, of the thread *a e*; for, had we supposed the vessel to

advance to b , then the angle $c a B$, would be a right angle, as $c b B$, and there would be no recession of the water—that is, no slip. The screw, therefore, in moving through the space $A a$, in consequence of slip, displaces a column of water equal in diameter to that of the screw, through the distance $b a$, which is, therefore, the measure of the power ineffectually applied in propelling the vessel.



From this, it then appears, that the angle at which any part of the screw strikes the water, is equal to the difference between the angle to which that part of the screw is formed, and the direction in which it moves in accordance with its own rotary motion, and the forward motion of the vessel. This angle, however, it must be observed, decreases from the periphery towards the centre, where it becomes *nothing*, and, in consequence, the propelling power is there also *nothing*. It is even a negative quantity; for, whenever the moving disk of the screw ceases to act as a propelling surface, it is worse than useless, since a certain amount of it must obviously be consumed in maintaining its motion in the water.

It would involve much intricate calculation to express these circumstances in general language; but, referring to the screw of the Archimedes, which is still the best known, we have the following data:—The pitch is 8 feet, and the periphery 18 feet; and, as already stated in another form, the amount of slip is 1 foot 8 inches in one entire revolution of the screw. But the total amount of motion imparted to the water at right angles to the plane of the screw is slightly

less, namely, 1 foot 7 inches. The rotary motion is greatly less. Taking the maximum lateral displacement—that is, the total distance to which any part of the fluid is projected at right angles to the axis—the amount at the circumference does not exceed $8\frac{1}{2}$ inches, and at 1 foot from the centre, where the circumference described is equal to the advance of the slips, and where, consequently, the lateral motion is a maximum, it only amounts to $10\frac{3}{4}$ inches. And, it may be observed, generally, that in any screw, the maximum lateral displacement is only equal to half the slip, and occurs at that part of the screw where the circumference is equal to the advance of the slips.

From the principle indicated, we readily determine the pitch which any screw ought to have. The rule is thus expressed by Mr. Gallo-way:—Divide the velocity in feet per minute, ÷ the assumed amount of slip, by the number of revolutions the screw is intended to make per minute, and the quotient will be the pitch of the screw in feet. Thus, supposing the intended speed of the vessel to be 10 miles an hour, (860 feet a minute) the expected slip 2 miles per hour, (172 feet per minute) and the number of revolutions of the screw to be 120 per minute.

	Revolutions.		Feet.		Revolution.
Then say	120	:	$860 \div 172 = 1032$	:	1

= 8.6 feet the pitch

of the screw.*

In these remarks we have taken no account of the friction encountered by the surface of the screw. By decreasing the pitch, it is obvious that the angular loss will be proportionally diminished; but, it is, at the same time, obvious, that as we decrease the pitch we must increase the surface either directly, or by augmentation of velocity, and thereby increase the friction of the screw upon the water. This friction will, of course, depend much in amount upon the construction of the screw; but, however smooth the surface may be made, it must gradually increase towards the centre, in comparison with the propelling effect. But as the form of screw would lead to a complicated calculation with such data as we possess, we prefer to subjoin the following table of experiments undertaken by Mr. Brunel, jr., for the purpose of determining directly the probable amount of power consumed in overcoming the friction of a plate equal in diameter to the screw of the Archimedes, namely, 5 feet 9 inches. The plate had nearly one-half cut away, and was placed upon a vertical axis, near the edge of section, and made to revolve horizontally in a cistern with, and without, water, as noted in the table, and at different velocities.

* Appendix D, to Tredgold's Treatise on the Steam Engine.

Experiments made at the Great Western Steam-Ship Works on the Friction of a Disk of Iron Revolving in Water; present, Messrs. Brunel, Claxton, Guppy, Humphrey, and others. Sept. 1840.

Mark of Experiment.	Mean Pressure on Piston, lbs.	Strokes.	Horses' Power by Indicator.	Revolutions of the Disk.	State of the Cistern.
<i>a</i>	4.6	36	6.0	89	empty.
<i>b</i>	4.3	37	8.79	91	do.
<i>c</i>	4.8	39.3	6.87	98	do.
Card No. 2					full of water.
<i>d</i>	6.39	38.5	8.9	96.0	do.
<i>e</i>	5.70	35.5	7.37	83	do.
<i>f</i>	6.30	45.8	10.45	113	do.
Indicator Card No. 3,					
<i>g</i>	6.6	49	10.78	119	full.
<i>h</i>	6.53	47	11.1	117	do.
<i>i</i>	6.51	45	10.6	113	do.
Indicator Card No. 4.					
<i>k</i>	6.2	41	9.2	101	full.
<i>l</i>	6.0	40	8.7	100	do.
<i>m</i>	5.7	38	7.8	94	do.
Indicator Card No. 5,					
<i>n</i>	4.62	41	6.90	102	empty.
<i>o</i>	4.65	39	6.80	98	do.
<i>p</i>	4.70	37	6.30	92	do.
Indicator Card No. 6,					
<i>q</i>	4.5	37	6.0	92	empty.
<i>r</i>	4.3	41	6.4	101	do.
<i>s</i>	4.4	38	9.0	94	do.
Indicator Card No. 7,					
<i>t</i>	5.6	36.5	7.4	91	full.
<i>u</i>	5.8	38.0	8.0	94	do.
<i>v</i>	6.2	40.0	9.0	100	do.
Indicator Card No. 8,					
A	6.21	40	9.0	99	full.
B	6.30	43	9.8	107	do.
C	6.24	42.5	9.6	106	do.
D	7.10	48.0	12.4	120	do.

These experiments are defective, inasmuch as the direct resistance produced by the edge of the plate is confounded with the surface friction; and still more so, in consequence of the disk being made to revolve in a comparatively small amount of water, in which some degree of rotary motion would speedily be produced by the revolving

disk. It is, however, to be observed, that the gross resistances exhibited in the table, follow very closely the same law as that which governs direct resistance alone; in other words, it is as the square of the velocity. We, therefore, conclude, that the surface friction is likewise as the square of the velocity. It must also be kept in recollection, that the absorption of power by surface friction, is not entirely peculiar to the screw, but extends, though possibly in a much less degree, to the ordinary paddle-wheel; for it is obvious, the floats must encounter a certain amount of friction as they successively enter and leave the water, and which will only be less than that encountered by the disk of the screw, in consequence of their velocity being less. The resistance arising from the edges of the floats in passing through the water, is also to be placed against the resistance encountered by the cutting edge of the screw, and the bearing. This last may be reduced greatly from what it appears in the Archimedes, and the former may also be greatly and advantageously modified, as in Mr. Rennie's propeller.

But apart from these considerations, which may seem to partake more of the character of opinion than of actual fact, it is to be observed, that the results obtained with the Archimedes, as compared with other vessels of good character, show that the sum of the resistances in the screw does not exceed those encountered by the ordinary paddle-wheel. Remarking, that in the case of the Archimedes, the engines are not of the first character, that the gearing by which the power is transmitted to the screw is ill proportioned, and consumes much power needlessly in overcoming the friction of the parts, as well as the constant vibration maintained during the working of the engines. The screw with which the early experiments were made was also very roughly constructed, the surface very unequal, and the bearing clumsy. Yet, under these unfavorable circumstances, and with a power calculated from the effective pressure on the piston, and without deduction for friction, of 145 h. p., the vessel's average speed (in her circumnavigation of Great Britain, in which she sailed 2006 nautical miles in 237 h. 25 m.,) was fully 8.45 nautical miles an hour, and in smooth water fully 9 knots an hour. Comparing this with the gross power of the Great Western's engines, when propelling that vessel at the same velocity, with the advantage of better lines, and greater dimensions, there does not appear to be any discrepancy which would indicate that the screw is less effective than the paddle. Reducing the speed of both vessels to 8 knots an hour, to agree very nearly with several experiments upon both vessels made in smooth water, and when the Great Western was rather more than her average depth in the water, the results stand as in the following table:—

Actual Dimensions.		Relative Dimensions and Power.	
Area of Midship Section Immersed.	Areas of Propelling Surface.	Area of Propelling surface. Midship section = 1.	Engine Power Expended.
Great Western, . . 520 feet,	220 square feet,	0.423	1.023
Archimedes, ... 122 "	26 square "	0.213	1.026

That is, the speed being the same, the power expended is very nearly the same; that is, very nearly one h. p. *gross* to one foot of midship section; while the propelling surface in the Archimedes is only one half of that in the Great Western.

As respects efficiency, it, therefore, appears, that the screw is not in any marked degree, inferior as a propeller to the ordinary paddle-wheel, nor does it seem to possess any superiority. In point of applicability, it has both its advantages and disadvantages. One manifest hindrance to its use in small vessels, designed for shallow water, is the depth to which it projects, and the danger which would constantly attend it of going aground in depths of water quite sufficient to allow a vessel of the same draught of water to be propelled by paddles. For river steamers, therefore, the screw seems a less applicable, and less desirable appendage, than even the bulky paddle boxes; for if once aground, it is useless as a propeller, and should it get aground in a current, there is much probability that the vessel will drift, and leave it. This objection disappears in contemplating its application to a sea-going vessel, with which it has always a sufficient depth of water, and is manifestly less liable to accident and derangement than the paddle. In respect of application it possesses a decided advantage, in admitting of a better, stronger, and simpler form of vessel, with the same amount of material; it requires no paddle-boxes, and to that extent the vessel will be less acted upon by head winds and seas. It is also unaffected in its operation by the trim of the vessel, and allows of the free use of sails. One remarkable advantage of which its application admits, is the increased facility it affords of steering the vessel, owing to the increased current of the water upon the rudder; for, contrary to the opinion which was entertained in the infancy of steam navigation, the greater the velocity of the vessel, the greater is the command of the rudder upon her motion. When the old Comet was ready to be applied upon the Clyde, the proprietors had some difficulty in finding a person to act as captain of it, on account of the supposed difficulty there would be in navigating it at some eight miles an hour through the windings of the river; and latterly, we believe, the command was entrusted to a school-master, who had none of the prejudices inherited by the old *skippers*.

The screw also admits of considerable reduction of the breadth of beam, and of the top weight—which are manifestly of importance in

sea-going vessels. The weight of the paddles is placed entirely below the water line, and no part of the engines need ascend above the same level. In the Princeton steamer, of which a notice was published in our pages of last month, the whole engines and boilers are stated to be four feet below the line of the water. This property may, indeed, be overdone to such an extent as to give the vessel a pendulous motion, which would be about as injudicious as to leave her deficient of ballast. But the power of regulating the trim of the vessel is a property which may be taken advantage of with judicious effect, and which it is highly desirable to possess.

Perhaps the most important property possessed by the screw over the paddles, is its remaining at least very nearly equally effective at all depths of immersion. When a vessel is deep, and the paddles, consequently, deeply immersed also, their action is materially impeded, and a great part of the power of the engines is absorbed in giving motion to the water; when too light, again, the floats do not take sufficient hold of the water, and the amount of slip is, in consequence, greatly increased. In both cases power is wasted—on the one hand in *stirring* round a mass of water needlessly, and, on the other, by ineffectually revolving the paddles. When the vessel is deeply immersed, the greatest effect is required to overcome the increased amount of resistance; but under these circumstances the power is least effective; and, hence the numerous contrivances which have been published under the name of *reefing paddles*, to obviate the evil. In bad weather, also, an enormous loss of effect is experienced in consequence of the rolling of the vessel, the one paddle being too deeply immersed, and the other not sufficiently. These circumstances may, at first sight, seem trivial, yet, in sea-going vessels, it is calculated that not less than a third of the actual power expended is thereby inefficiently absorbed.

It is not presumed, that with the screw the immense sacrifice of power here indicated, would be wholly avoided; but the presumption is, that a large amount of it would be rendered effective in propelling the vessel, and to that extent, *cæteris paribus*, the screw is to be preferred.

Nor can we suppose the screw to be a more delicate instrument of propulsion than the paddles. These last—as every one interested in steam navigation must know—are a constant source of trouble and expense, and are hardly capable of being kept in a good state of repair. This is not at all surprising, considering their lightness of structure, and great size, and that they are constantly subjected to concussion upon the water, independently of extraordinary shocks from heavy seas. From all this the screw is free; its action is uniform, and constantly the same. It cannot be exposed to variations of pressure of the slightest moment, unless it should happen that the vessel was subjected to lateral motion by a heavy sea running obliquely to her course, which can hardly be expected to occur to an extent which would materially affect the safety of the screw bearings, and these are the only parts which it is possible to imagine would at all be endangered by an occurrence of that sort.

One objection which has been frequently urged against the screw as a propeller at sea, is the probability of its being lifted out of the water by the pitching of the vessel in a rough sea. This, however, applies far more forcibly to paddles than to the screw, which is much more deeply immersed, and, therefore, less likely to lose its hold of the water than the float-boards of a paddle wheel. The objection, however, acquires no support from experience; for, in the first place, it is well ascertained that a steamer at sea never pitches to so great an angle as that to which she rises; and, in the next place, she is almost invariably meeting, or passing, the seas, and, consequently, although heaved very violently, the effect is not such as is likely in any way to endanger the action of the screw. The form of the vessel, moreover, ensures an almost steady motion of the stern, even when the swell is very considerable. The variation of displacement of the stern is very rapid—falling off almost to nothing at a few feet below the water-line, and spreading out to a great extent at a few feet above. Forward again, the difference of displacement is comparatively small, and, consequently, the centre of motion is thrown very considerably aft. While the bows, therefore, are thrown alternately high and low in the water, the stern floats nearly steady, the vessel resting on the broad counter nearly at the centre of motion. This circumstance has been minutely observed, and is not stated on merely hypothetical grounds; and, moreover, it was never found that the screw of the *Archimedes* was uncovered in the roughest weather to which she has been exposed.

The main difficulties attending the application of the screw, consist in the mechanical appliances for conveying to it the motive power of the engines, and for attaining the requisite number of revolutions. The means hitherto put in operation, seem to us, without exception, to be defective. The use of toothed gearing for a purpose of the kind, is, at best, little consonant with our ideas of strength and security against accident. It is true, that toothed wheels may be made sufficiently durable to obviate ordinary casualty, but still they are far from being desirable accessories to a marine engine. Belts and ropes seem still less free of objection. For light machinery, we fully admit the virtue of connexions of that nature; but in cases where 500 to 1000 h. p. are to be transmitted, we much doubt that some connexion less elastic will be required. We do not certainly anticipate in this any thing more than a mere mechanical difficulty which will disappear—as others, apparently, far more formidable have disappeared, and are now forgotten; but, in the meantime, we see no other real difficulty to be surmounted in the application of the screw as a propeller. In this, however, we say nothing regarding the kind, or form, of the screw which we conceive to be the most appropriate and economical as respects efficiency; in the preceding remarks, we have referred only to the form of screw employed in the *Archimedes*; but we have done so, simply because it is the most generally known, and to save discussion.

On M. De Prony's Brake, or Friction Dynamometer. By WILLIAM STEWART.

I beg leave to offer you the following observations on the article relative to M. de Prony's friction dynamometer, given in your pages for October and December last.

I entirely agree with you in respect of the utility, the simplicity, the elegance, and the accuracy of that mode of measuring the mechanical power of prime movers; but I think that the description you have given of the form, and more especially of the dimensions of the brake, employed by Captain Morin, in his experiments on water-wheels, is ill calculated by reason of the expense incurred, to bring into general use an instrument which seems to me about as necessary in the sale and purchase of prime movers, more especially steam engines, as the common balance is in the sale and purchase of grocery goods.

Captain Morin, without doubt, made the brake which he employed, purposely of sufficient strength, to be able to accomplish without accident, or repairs, the series of experiments which he intended to make; and, to make sure of this, no expense was spared, no second consideration, such as the trouble and expense of carriage, occupied his mind,—and, as you inform us, “the whole did not exceed 500 lbs.” From this statement, we may presume, that the weight of iron in the composition of the brake was nearly, perhaps altogether, 500 lbs.; the expense of which, including the workmanship, may have been £16; but very few persons will be disposed to lay out such a sum to try an experiment, which, to many, may not appear decisive, and to others it may appear unnecessary. It is certain, that in ordinary cases, such an expense is unnecessary, as will appear hereafter.

In 1821, I was, from accidental circumstances, charged to clean, examine, and repair, if necessary, the steam engine on which M. de Prony performed the first experiment with his friction dynamometer; I may state, in confirmation of what I here advance, that in executing my task, I put two new cast-iron tubes of 9 or 10 inches diameter into the boiler, the old tubes having been left full of water, and being unemployed during the severe winter of January, 1821, were rent by the congelation of the water, nearly from one end to the other, in a direction parallel to the axis. Most of the joints in the boiler had also to be renewed; all the working parts of the engine were taken apart, cleaned, carefully examined, and with equal care returned each piece to its place. Nothing was wanting in the engine except a few springs to be changed in the metallic piston of the steam cylinders; the repairing of a few joints, and, what was more essential, the filling up of a blown hole, nearly an eighth part of an inch in diameter, in the steam cock of one of the cylinders, which was so situated as to admit the steam from the steam pipe, communicating with the boiler into the steam cylinder on the opposite side of the piston, at the time it ought to have been exhausted.

Apart from these small exceptions, the engine, in all its parts, was of the very best workmanship, executed at Messrs. Ferrier and Ed-

wards' manufactory at Chailot, in Paris. The engine was situated in Gros Cailau, in Paris, on the left bank of the Seine, and destined to raise water for the use of the city.

The engine was of the high pressure kind, with two cylinders, on the principle invented by Mr. Woolf, and was constructed under the direction of Mr. Edwards, previously a partner with Mr. Woolf, under the firm of Woolf & Edwards. The engine was sold to Mr. Ferrier, director, and, I believe, proprietor of the said water works, as equivalent to 20 horses power, but was found by M. de Prony to be equal to 16 horses power only.

From this experiment I infer, that there is error and exaggeration in the supposed advantage of double cylinders, with expanding steam on Woolf's principle. The firm of Ferrier & Edwards never would have sold an engine for a power greater than that which they believed it to be capable of giving—and previous to this experiment of M. de Prony, there was no method other than vague calculation to ascertain the power of steam engines.

These details which have not hitherto been published, and which perhaps none but myself could give circumstantially, may be interesting to many of your readers, inasmuch as they are connected with the subject of your article before alluded to, and with the first application of the friction dynamometer. Other reasons, however, have determined me to communicate them, viz., 1st, because it is universally agreed, that in performing any experiment, every circumstance connected with the experiment ought to be noted, both before and after, as well as during the experiment; for the reason that sometimes circumstances apparently unimportant at the time, may afterwards lead to important results. 2nd, because I consider the experiment by M. de Prony, on the steam engine, at Gros Cailau, as being decisive in showing the fallacy of the estimated power of double cylinder steam engines, as introduced by Messrs. Woolf & Edwards. It is of importance to state, that nothing was wanting to render the experiment complete; the engine was perfectly new, having been at work only a few days after its erection—that it was most efficiently constructed, and highly finished—that immediately preceding the experiment it was carefully examined, cleaned, and repaired, where wanted, in all its details, and that for the express purpose of being tested by M. de Prony, and by order of a legal decision of one of the courts of law in Paris. 3rd, because this experiment is a striking example, showing how it happens, that from small, and apparently, trifling, causes, sometimes great results are obtained; in this case, I am satisfied in my own mind, that had the small *blown* hole already stated to have been discovered in the steam cock not existed, (which hole must have reduced the power of the engine, at least, one-half,) it is probable that no discussion between the buyer and the seller of the engine would have taken place,—and that M. de Prony would not have been called upon to test the power of the engine; and, consequently, on that occasion, at least, his attention would not have been directed to the investigation of the measurement of the force of prime movers, and his ingenious and simple dynamometer might have been

as yet unknown. And 4thly, allow me to add that I feel proud in being able to associate my name with a circumstance which gave occasion for an invention, characterized by you "as one of the most elegant and useful inventions which France has bequeathed to practical mechanics."

But, to resume, the brake, or friction, band employed on this occasion by M. de Prony, did not, like that of Captain Morin, weigh 500 lbs. Its weight did not exceed 25 lbs., neither was it necessary that it should.

Since that time I have had occasion, in contested cases, to employ the friction dynamometer, and can assert that, when applied to test the power of steam engines of twenty horses' power, the iron work may be made under 20 lbs. weight, and the whole expense not exceed £1. For water-wheels with wooden shafts, a larger and stronger friction-pulley and band is necessary; but even for that, in ordinary cases, 100 lbs. weight may be sufficient. An expensive link-chain is not essentially necessary: a bar of flat iron, or strong sheet-iron, bent, will answer equally well, and the cost not exceed £4.

Four sets of setting screws, for the ring, or pulley, is preferable to three sets, as every practical mechanic knows. A plate of iron ought to be put between the point of the set screws and the wooden shaft, and the open space between filled with wooden wedges, as described by Captain Morin. For cast-iron shafts, a very small friction ring will suffice. The expense will be reduced in proportion.

From what has been here stated, it appears certain that the practical operation of ascertaining the power developed by prime movers, by the use of M. de Prony's dynamometer, is as simple, as easy, and as little expensive in its application as you have shown the calculation to be.

Liverpool, March 12, 1844.

Ibid.

Proceedings of the Institution of Civil Engineers.—From the London Athenæum.

Atmospheric Railway—June 4.—The applicability of the system of the propulsion of railway carriages, by the pressure of the atmosphere upon a piston, traveling within an exhausted line of pipes, has occupied a portion of three meetings; and, although much time has been devoted to the discussion, it cannot be said that any positive conclusion has been arrived at. Indeed, when it is considered that the system has only been tried upon a line peculiar in its locality, in its steep gradients, in the engine having only to exert power in drawing the carriages in one direction, and their descending by their own gravity, and in the trains being only required to run a distance of a mile and three quarters, without stopping at any intermediate station it may be argued, that although, as is evident from the testimony of the several speakers, great results have been obtained, it is scarcely possible to infer what the results would be on lines with gradients in

both directions, with a great number of heavy trains at short intervals and under all the varied circumstances of ordinary traffic. It appeared, however, to be the opinion, that the present system of atmospheric propulsion, although susceptible of much improvement, was in a more advanced state than the system of traction by locomotives, at a corresponding period from the date of the introduction of the several systems. The various previous plans of Medhurst, Vallance, and Pinkus, for somewhat similar systems, were explained; and it was shown that the system had been taken up by Clegg and Samuda, where the former speculators had abandoned it, and, as usual in such cases, the practical improvers had been more successful than the inventors. The principal improvement is in the continuous valve, and the mode of closing it by a mixture of tallow and bees-wax, which, under all variations of temperature, remained unchanged, and enabled a good vacuum to be formed. Many other alterations in the mechanical details were also described. Mr. B. Gibbon, engineer of the Dalkey line, stated his satisfaction with the manner in which it worked; thirty-five trains per day had at times been conveyed without danger, and with regularity; the train was enabled to be started in one minute after the engine commenced working to form a vacuum. Mr. Samuda detailed the progressive trials at Wormwood Scrubbs during two years and a half, until it was laid down at Dalkey, where a load of 50 tons had been propelled up gradients averaging 1 in 115; and a maximum velocity of nearly 50 miles per hour had been obtained, with an engine which was stated to be 100 horse power, using as a divisor, 66,000 lbs., raised one foot high in a minute. This deviation from the ordinary calculation of Boulton and Watt, who used 33,000 lbs., was justified on the plea, that steam engines were now made in such a superior manner, that their effective nearly doubled their nominal power, and that the usual acceptance of the term "horse power," was no longer to be relied upon. This position was combatted by several members, who argued that the commercial question should not be mixed up with the scientific inquiry; and that for the latter purpose the accepted divisor of 33,000 lbs., for the horse power, should have been used, when the power exerted would have appeared nearly double what had been quoted, which would materially affect the question of the cost of first laying down, and the expense of subsequent working. In considering the comparative merits of traction by locomotive engines, by fixed engines with ropes, and propulsion by the atmosphere, it was argued, that in the two former cases, the weight of the moving power must be carried along the rails at a corresponding cost and loss of power, added to which was the loss resulting from the slip of the driving wheels in the one case, and the friction of the rope against the pullies in the other; the destruction to the rails, resulting from the beat of the driving wheels, being put out of the question. Against this it was argued, that with the atmospheric system, the whole power of the engine must be used,—whether for heavy, or light, trains; that a power capable of pumping out the leakage, stated at 10 horse power per mile, must be always provided, although it was only exerted for a part of the length of each

section; and that the real power employed at Dalkey, if calculated by the usual standard of Boulton and Watt, was shown by indicator diagrams to be nearly double what had been stated, and that, consequently, a greater outlay was required than was imagined. The additional security in traversing the rapid curves of the railway at high speed appeared to be admitted. A curious circumstance was mentioned, which deserves more attention—it was, that the temperature of the air, on leaving the exhausting air pump, was increased to upwards of 200 degrees; and that there was a certain absorption of power consequent upon this increase of temperature. Although much time has been devoted to the discussion, the question was not fully examined, nor were all the necessary data clearly stated, so that for all practical purposes we shall only arrive at the comparative value of the new system after it has been applied to such a line as the Epsom.

Purifying Coal Gas—June 11.—Mr. A. Angus Croll read a paper on the purifying of coal gas, and the application of the products thereby obtained, to agricultural and other purposes. The process consists in passing the gas through a solution of sulphuric acid of the strength of two and a half pounds of oil of vitriol to 100 gallons of water, and by a continuous supply of acid, so that the proper amount of free acid might be always kept in the vessel, the whole of the ammonia in the gas was abstracted, preventing the corrosive effect of this impurity on the fittings and meters through which it was transmitted, and rendering the gas capable of being used in dwelling houses, and also enabling the gas companies to use dry lime, instead of wet lime, purifiers without producing any nuisance on the opening of the vessels, by which a considerable saving was effected, while, at the same time, sulphate of ammonia of great purity is obtained, and of such a strength that the evaporation of one gallon produces eighty ounces of this valuable salt, instead of fourteen ounces, which was the quantity rendered under the former process. The author concluded by showing the advantage to agriculture by the application of this produce; he stated that various experiments, upon an extensive scale, had been tried with this manure with great success: one example will suffice for giving an idea of its powers. One half of a wheat field was manured with sulphate of ammonia, at the rate of $1\frac{1}{4}$ th cwt. to the acre, and at a cost of 17. 2s., the other half with the ordinary manure; the latter produced only $23\frac{3}{4}$ bushels, but the former under the treatment of sulphate of ammonia produced $32\frac{3}{4}$ bushels. In the discussion that ensued, in which Prof. Grahame, Mr. Cooper, and many members took part, the advantages of the system were confirmed, and the necessity for its extension insisted upon. The various modes of purifying gas, and the value of the products obtained for agricultural purposes, were canvassed at length. It was stated, that seeds steeped for 40 hours in a solution of one pound of sulphate of ammonia to one gallon of water, sown in unmanured land, produced a heavy crop, and remained green during a dry season, when every other kind of vegetation became yellow and withered. Another remarkable feature

was, that faded flowers when plunged in a weak solution of sulphate of ammonia, were, in a short time, restored, and that plants watered with it attained extraordinary health and beauty. The great loss resulting from the leakage of the gas through the joints and the pores of the cast-iron pipes, was incidentally mentioned, and it was stated that in some instances it had amounted to from 25 to 75 per cent. of the total quantity produced.

Supply of Water in case of Fire—June 18.—A paper by Mr. Braidwood, superintendent of the fire brigade, gave the results of his experience as to the best means of rendering large supplies of water available in cases of fire, and on the application of manual power to the working of fire engines. The author stated, that if water could be obtained at an elevation, pipes, with plugs, or fire-cocks, on them, would be preferable to any mode at present in use, and that the best mode of using manual power was by applying the greatest aggregate amount of power to the lightest and smallest machine; that the reciprocating motion was to be preferred to the rotary; and that a fire engine with two seven inch cylinders, and eight inch stroke, weighing seventeen and a half cwt., was the most advantageous size that could be adopted.

Combustion of Coal.—In the paper by Mr. A. Murray, the author considered the quantity of atmospheric air chemically necessary for the complete combustion of a given quantity of coal. The practical recommendations given, were, that the supply of air should be as free as possible; the entrance into the ash-pit should not be less than one-fourth part of the area of the fire grate; the depth of the ash-pit should be about two feet and a half, no advantage being found to result from its being deeper; the space between the fire bars should be 7-16th inch, but that depth should be regulated by the kind of coal used; for any kind of coal it should not be less than 3-8th inch, nor more than half an inch; the fire bars were recommended to be made as thin as was consistent with their required strength; half an inch in width had been found to be a good proportion. The space in the furnace above the fire bars was recommended to be made large, about three cubic feet to each superficial foot of fire grate, when such an amount could be obtained. The proper area of the flue was next considered, with reference to the bulk of the products of combustion and their velocity, showing that the area requisite for the quantity chemically required was found to be much too small, and, that in practice, it should not be less than two square inches for the products of combustion from each pound of coal consumed in the grate per hour. Taking a furnace in which thirteen pounds of coal were burned on each square foot of fire grate per hour, (which was stated to be a usual rate of combustion in steam boilers,) the area of the flue to every superficial foot of the grate would be twenty-six square inches. The area of the chimney was recommended to be three-fourths of that of the flue. The mode of conducting the flue to the chimney, and the angles formed in its passage, were also considered. The time occupied by the gases in passing through the flues of a

boiler, from the instant of their generation to that of their reaching the chimney, was shown not to be of importance, provided that the incandescent gases were to be sub-divided, that all the particles were brought into contact with the boiler, and were made to part with their caloric, as was the object in the construction of locomotive and other tubular boilers. The amount of heating surface recommended was in the proportion of eighteen square feet to each foot of fire grate where the combustion was carried on at the rate of 13 lbs. per square foot per hour, though a larger amount might be employed in land boilers, where there was no objection against cooling down the products of combustion in a greater degree. The principles were stated to be applicable to all kinds of boilers, used either for land, or marine, purposes.

Removal of the Sunderland Light-House—June 25.—A paper was read descriptive of the removal of the light-house on the North Pier at Sunderland, by Mr. J. Murray. The light-house, built in 1802, was 76 feet in height, and 15 feet in diameter at the base, slightly tapering upwards to the lantern. It was built of polished stone, and had within it a spiral stair-case; its total weight was 338 tons, which being concentrated on an area of only 162 square feet, rendered the task of its removal in an entire mass a work of much difficulty and danger, especially when its height was considered. Mr. Murray was induced to propose its removal without taking it down, in consequence of the expense which would have been incurred in the establishment of a temporary light on the pier, the cost of building another light-house, and the success with which dwelling houses had been moved entire in the United States. The decision was accelerated by a serious breach being made by the sea on the wall of the pier on which it stood, and in consequence the work of removal was commenced on the 15th of June, 1841, by the masons cutting the holes for inserting the timbers for forming the cradle; those directly beneath the building were carried by 144 cast-iron rollers, traveling on eight lines of iron rails, and the outer timbers supporting the braces and struts, were placed upon slide balks, which were lubricated with a mixture of soft soap and black lead to diminish the friction. The power applied was by means of several drawing and pushing screws, and by three winches, with ropes and tackle blocks, worked by eighteen men. On the 2nd of August, the mass was moved a distance of 28 feet 6 inches in a northerly direction, to place it in the line of the new pier. After changing the position of the rollers and slide balks to adapt them first to a curve of 647 feet radius, and then to a straight line in an easterly direction, the cradle with its load was propelled steadily forward, at an average rate of $33\frac{1}{2}$ feet per hour when in motion, the entire time of moving over 447 feet being thirteen hours 24 minutes. Much time was, of course, occupied in taking up and relaying the rails and balks, and in preparing a solid foundation for them as the mass advanced; so that it was not until the 4th of October, that the light-house arrived at the extremity of the pier, where the foundation was prepared for it. The timbers were withdrawn gradually, the spaces

being filled up with solid masonry, and the building was stated to have remained to the present time in a solid state, without the slightest appearance of even a crack in the walls. A light was exhibited in the lantern, as usual, every night during its transit. The entire cost of executing the work was \$27*L.*, and it was shown that an actual saving of \$93*L.* had been made by adopting the plan of removal, instead of building a new light-house.

Constructions to Retain the Sides of Deep Cuttings, &c.—A paper by Prof. Hosking, containing some suggestions for the introduction of constructions to retain the sides of deep cuttings in clays and other uncertain soils, was then read. These constructions were chiefly intended to be introduced in situations where, on account of the bad nature of the soil, open cuttings, or tunnels, would be expensive and dangerous; they consisted of buttress walls, placed at intervals along the length of the line, and opposite to one another, strutted at their toes by an inverted arch, and above by built beams of brickwork, at given heights, discharging arches being turned from buttress to buttress to carry the beams; the buttresses were to be made the springing walls of longitudinal counterarched retaining walls, and all the force exerted against them would be converted to the buttresses, and from thence to the arches and built beams. The author then gave a detailed estimate of the expense of forming an open clay cutting with slopes at $2\frac{1}{2}$ to 1, and of the proposed constructions, the same data being taken in both cases, from which it appeared that the difference was nearly one-third in favor of the construction. It was stated by Capt. Vetch, that a similar kind of construction had been successfully used in the Moseley cutting, on the line of the Birmingham and Gloucester Railway, and General Pasley stated that Mr. Adie had introduced that kind of construction on the Bolton and Preston Railway.

Rebuilding the Piers of Sarclet Harbor.—A paper, by J. Bremner, described the mode adopted by him for rebuilding the piers of Sarclet Harbor, (Caithness, N. B.) after they had been twice destroyed by the sea, to whose action it is much exposed, the waves frequently breaking over the works at a height of 50 feet. The works required to be completed with great rapidity, as the season in which they could be carried on was very limited. Mr. Bremner, therefore, contrived several gigantic cranes, which were fixed at about 20 feet above high water mark, the longest commanded a radius of 115 feet, and by it a cargo of 20 tons of large stones could be unloaded from a barge, and conveyed a distance of 230 feet in half an hour; and it afforded similar facility for laying the blocks of stones in their places in the building, as also for depositing materials in front of a breach which had been made by the sea in the new works, which, without such efficient means, would have been, as before, entirely destroyed. The machinery and general mode of building adopted by Mr. Bremner, were described, and some remarks as to the inefficiency of vertical pier walls for resisting the force of the waves in exposed situations appeared to attract attention.

Experiments on the comparative Strength of Hollow and Solid Railway Axles.

At the meeting of the Institution of Civil Engineers, on the 23rd ult., a report was read of the result of some experiments made under the superintendence of Mr. Bury, of the London and Birmingham Railway, at Wolverton, on the comparative strength of hollow and solid railway axles. The result of these experiments showed that the solid axles resisted the effects of torsion more than the hollow ones, and that while the journals of the hollow axles were broken by fifteen and seventeen blows respectively from a 30 lbs. sledge hammer, a solid axle received 374 blows from the same hammer before it was broken. All the axles experimented upon were made from precisely the same quality of iron, by the Patent Shaft and Axletree Company of Wednesbury. A report was also stated to have been received from Mr. M'Connell, of the Birmingham and Gloucester Railway Company, of experiments made for his own satisfaction, on an axle also made by the Patent Shaft and Axle Company, without any knowledge that it would be subjected to such trial. Mr. M'Connell's report, having been printed, was not read at the meeting, printed documents being excluded by the rules of the Institution, but as the subject is one of much interest to those connected with railways, and the public generally, we subjoin extracts:

The following is the statement of the experiments made by Mr. Bury, at Wolverton.

Ten hollow and ten solid axles were sent by the Patent Shaft and Axle Company, to Mr. Bury, and the lathe work was done under that gentleman's superintendence.

The soundness of the manufacture of the hollow axles was tested by two having been cut longitudinally through their centres.

A hollow and a solid axle were then placed alternately in a frame with each journal, in a firmly fixed block, and levers were fixed on the wheel seats in opposite directions. The length of the levers from centre of axle to centre of chain for suspending the weight, was six feet. Weight of lever 158 lbs., weight of chain 29 lbs., total 187 lbs.

	Hollow.	Solid.
Diameter of the axle,	4½ inches.	3½ inches.
“ journal,	2½ “	2½ “
“ wheel seats,	3¼ “	3¼ “
Length of journal,	5 “	5 “
Weight of axles,	189 lbs.	209 lbs.

The deflection was at a radius of two feet from the centre of the shaft. With a weight of six cwt., the deflection in the hollow axle was one-eighth of an inch; in the solid axle none; with a weight of 14 cwt., the deflection in the hollow axle was one-fourth of an inch, with a permanent set of 3-16ths lbs.; and on the solid axle 5-16th of an inch, without any permanent set. When the weight was increased to 22 cwt., the deflection of the hollow axle was 1 7-16; and of the solid 1 9-16—each of them having a permanent set of 1½ inch. The torsional effect of 22 cwt. was equal to 85 tons.

Experiments were then tried upon the journals of the axles, dimensions and weights as before ; they were firmly fixed on wheels, and the outside ends struck with a 30 lbs. hammer.

The first hollow axle fractured after receiving fifteen blows, and the journal broke with six further blows. The second hollow axle fractured after receiving seventeen blows, and the journal came off with fourteen further blows.

A solid axle then received one hundred blows on the end of its journal, without being fractured, or much bent. It was then turned over, and received one hundred blows in an opposite direction, bringing it into its original position without a fracture. It was then turned to the other quarter at right angles, and received eighty-seven blows, still without a fracture ; it was then struck eighty-seven blows in the place where the first hundred blows were given, which brought it off. The iron exhibited a fibrous texture in a longitudinal direction.

Mr. M'Connell's experiments, made in September last, were with a patent axle, taken indiscriminately from forty supplied to the London and Birmingham Railway Company, by the Patent Shaft and Axletree Company.

The axle was placed in a pair of tender wheels, and weights suspended from a lever, commencing with a weight of 347 lbs., equal to a torsional effect of fifteen tons, and gradually increased up to 1761 lbs., giving a torsional effect of seventy tons. The deflection, with the weights up to 700 lbs., was scarcely observable ; and with the extreme weight of 1761 lbs., it amounted to only eleven-sixteenths of an inch, with a permanent set of three-sixteenths.

Several blows were then given with a weight of 316 lbs., let fall from a height of $4\frac{1}{2}$ feet, and afterwards from a height of nearly nine feet, on the opposite side. The journal, after receiving eighteen, or twenty, blows, was then turned at right angles, and broke off with the first blow, exhibiting a fibrous fracture, and solid in the centre.

The journal on the opposite end of the axle was then tried with blows of a hammer 28 lbs. weight, and after one hundred blows, was bent about three-eighths of an inch. It was then turned one-fourth round, and was bent, by one hundred blows, three-sixteenths of an inch. Two other angles were then subjected to the same number of blows, and after receiving these four hundred blows it remained without a fracture.

An old axle, marked best scrap, was tried on one of the journals, with a hammer of the same weight, and broke with twenty blows, the fracture presenting a crystalized appearance ; this axle had been faggoted with flat bars. Journal $4\frac{1}{2}$ inches long, and $2\frac{1}{2}$ inches diameter.

An old axle, marked P, was next tried on the journal, which broke with fifty-eight blows of the same hammer, fracture presenting a fibrous appearance. Journal $4\frac{1}{2}$ inches long, and 2 9-16 inches diameter.

It was thought by some of the members that the cause of the comparative weakness of the hollow axles, arose from the difficulty of preventing an inequality on the inner surface, and that it would be

satisfactory if further experiments were made on the hollow axles, in which particular attention was paid to this point.

A paper was then read by Mr. Glyn, relative to the fracture of railway axles, which he attributed to the constant succession of blows received by the axles in traveling. The action was stated to be similar to that of an axle laid on the edge of an anvil, and subjected to a series of smart blows of a hammer, while in constant rotation. The fracture presented the appearance of a clean annular cleft all round for the depth of half an inch into the body, the centre part being crystalized, and reduced so much as to be unable to bear the weight and the torsion to which the axle was subjected by the pressure of the brake on one of its ends. These observations had induced the railway company to apply the power of the brake upon both wheels simultaneously, thus avoiding the torsional strain.

Lond. Railway Mag.

AMERICAN PATENTS.

List of American Patents which issued in January, 1844, with Remarks and Exemplifications. By CHARLES M. KELLER, *Examiner of Patents.*

1. For an improvement in the *Combination Lock for Doors*; Sabin Colton, Philadelphia, Pa., January 6.

We have here another of that almost endless variety of devices for preventing the picking of door and other locks, by means of impediments put in the passage of the bolt, which are intended only to be removed by setting them to a combination of letters, or figures, which may, for greater security, be varied at pleasure. In the modification, under consideration, the bolt is thrown in and out by a knobbed spindle and bit, and the impediment to its inward movement is a slide which works in a box attached to the back end of the door-plate. When the bolt is out, and the slide is pushed and retained in, it projects from the lock-plate, and behind the bolt far enough to be a complete check, and it is retained in that situation by buttons, or disks, on the ends of three, or more, spindles that work in the slide. These buttons, or disks, have a portion of their diameter cut off, so that in one situation they are narrow enough to pass with the slide through the box, and in other situations they project beyond the width of the slide, and catch on to a piece which projects from the back of the plate; the forward end of these spindles is adapted to receive a key, by which they are turned, and by figures, or letters, marked on the key and door-plate, the combination desired can be formed and pointed out as in the Bramah Lock. The patentee claims "the manner in which he has combined the slide contained in the box, and the spindles therein carrying the buttons on their ends, which are made to catch on the piece" projecting from the back of the lock-plate,

"when acted upon by the key; said apparatus operating as a whole, substantially as described."

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2. For an improvement in *Platform Spring Scales*; George R. Moore, Brattleboro', Vt., January 6.

Instead of attaching, or suspending, the article to be weighed to a rod attached to a spring, according to the usual mode of making spring scales, it is placed on a platform attached to the top of a vertical rod suspended by the ends of a cross bar attached to it, to two arms of a rock shaft, which is also provided with two other arms opposite to them—to one of these the spring is attached, and to the other, which is longer, is suspended a dish to receive the weights for weighing beyond the force of the spring. From one end of this rock shaft another arm extends down, and is jointed by a link to an index hand, turning on a pivot, which points to the graduations on an index on the box that surrounds the whole, except a portion of the hand, and the end of the lever to which the dish is suspended. The lower end of the rod to which the platform is attached, is kept in a vertical position by a jointed bar, in the usual way.

The claim is limited to the "combination of the spring balance, with the steel yard, substantially, in the manner described." "And, also, in combination with the above, the hand, or indicator, and index, arranged as specified."

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3. For an improved *Let off Motion for regulating the delivery of the Yarn in Weaving Looms*; William H. Brayton, Warren, Bristol county, R. Island, January 6.

The yarn beam is, by means of a cog-wheel and pinion, put in connexion with a friction pulley, around which passes a friction band, having one end fixed to the frame by a screw adjustment, and the other by means of a rod, or spring, to the lower end of an upright lever jointed to one of the swords of the lathe, the upper end of which is jointed to a finger, or short arm, projecting downwards from a small shaft extending across the back of the lathe; and from this shaft project upwards, two other arms, or fingers, which bear against the back of the flighter, or spring reed. The yarn is not given out by the beam unless the friction band on the friction pulley is loosened, which does not take place until the strain of the web, in beating up, be sufficiently great on the flighter, or spring reed, to cause it to yield, and then, by the connexion above described, the friction band is loosened, and the yarn given out.

The claim is limited to the "mode of connecting the yarn beam with the flighter, by means of the friction strap and pulley."

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4. For an improvement in *Bee Houses*; Aaron E. James, Point Pleasant, Mason county, Va., January 6.

The patentee says:—"What I claim as my invention, and desire to secure by letters patent, is the combination of several hives furnished

with inclined floors, and two honey boxes on their tops with the bee palace in the manner set forth; that is to say, said hives being movable, and having the entrance for the bees in the middle, between the two inclined floors, and corresponding to an entrance in the floor of the palace, said entrance having an inclined alighting board, and slides to close the hives at pleasure."

5. For a *Machine for Moulding Bricks*; John Booth and William H. Stevenson, Columbus, Lowndes county, Miss., January 6.

In this machine there is a cistern with a vertical shaft and arms for mixing, or tempering, the clay in the usual manner. This cistern is square, and its bottom is pierced with four holes corresponding with the four sides of the cistern. Below this cistern the frame is adapted to receive two mould frames that run entirely across, at right angles to each other, and so let into each other as to slide freely at right angles, and have the tops of all the moulds (which are placed one set at each end,) level, and as nearly in contact with the bottom of the cistern as may be consistent with the operation of the machine. The moulds are filled in succession by an inclined board, called the filler, attached to an arm near the lower end of the mixing shaft, which, in passing around, forces the clay through the holes in the bottom of the cistern, into the different sets of moulds in succession. Below the filler there is a curved arm attached to the shaft, which acts as a cam to move the mould frames that are provided with rollers on opposite sides for this purpose. After the filler has passed over and filled a set of moulds, the cam follows and pushes it out, and the opposite set in, to be in readiness for the filler.

The claim is in the following words, viz.,—"What we claim as our invention, and desire to secure by letters patent, is the method of filling and returning the moulds, as described; that is to say, by means of the follower, or filler, and the curved lever, (cam) combined, operating, and arranged, substantially, as set forth. And we also claim the manner in which we have combined with the cistern and its revolving shaft for tempering the mortar, the mould carriages constructed, and operating, substantially, as set forth."

6. For an improvement in the *Air-tight Stove*; John Cline, Norwalk, Huron county, Ohio, January 6.

This improvement consists in adding to the well known air-tight stove, a small pipe which extends from the front of the stove to the smoke-pipe, or valve-plate, with the end turned, and extending a short distance up the smoke-pipe, for the purpose of giving a slight draught to carry off the gases and vapor generated in the stove. The claim is limited to this improvement.

7. For a composition of matter for rendering water-proof articles manufactured of leather, such as *Boots and Shoes, &c.*; William J. Roome, city of New York, January 6.

This compound consists of "32 parts mutton, or beef, tallow, either,

or both, 32 parts linseed oil, 24 parts yellow beeswax, 6 parts neats foot oil, 4 parts lamp black, and 2 parts litharge, or red lead." We are instructed to "place the materials in a pot of sufficient size, and reduce the materials to a liquid mass, by the application of heat, when all is melted to keep stirring the composition until it becomes nearly cold, or while in the liquid state to *fill* it into tin, or earthen, vessels, for use."

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- S. For an improvement in the *Flax and Hemp Breaker*; Constant B. Butler, Petersburg, Lincoln county, Tenn., January 6.

In the breakers heretofore known and used, the swords, or blades, that break the flax, or hemp, only act on it in one direction, and the object of the present improvement is to arrange them in such manner that they will act on both sides of it, and thus more effectually break the woody part. This is done by having two sets of permanent swords, or breakers, sufficiently far apart to receive the flax, or hemp, between them, and two sets of movable swords, or breakers, attached to a sliding frame, or gate, one set acting on the upward, and the other on the downward, movement of the gate.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the breaker by which the hemp, or flax, is acted upon in the upward, as well as the downward, stroke, thus acting on the opposite sides of the hemp; that is to say, I claim the combination of the upper and lower permanent breakers, or sets, with the upper and lower blades attached to the movable sash; this being the principle of the invention which I desire to secure."

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9. For a mode of straining the strings in the act of *Tuning Pianos*; Joseph S. Ives, Bristol, Hartford county, Conn., January 6.

The patentee says,—“In my improved method of straining the strings of piano fortes, &c., instead of the ordinary tuning pin, I employ with each string, a tuning pin which has a screw on it, intended to operate as an endless screw upon a worm-wheel which turns on pivots in a proper metallic bearing. The worm-wheel has a groove turned in it for the purpose of receiving the wire which is to be strained thereon. The lower part of the tuning pin is enclosed by a metallic socket, which is driven into the tuning pin block, where it is held permanently.

“What I claim as new therein, and desire to secure by letters patent, is the manner of forming and combining the tuning pin, the worm-wheel with its grooves, and the metallic support in which they turn, so as to receive and give tension to the respective wires, as set forth.”

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10. For a machine for preparing *Hands, or Bundles, of Tobacco*, for being packed; David Smith, South Hill, Brunswick county, Va., January 15.

The object of this improvement is to press the hands, or bundles, of tobacco, by means of rollers so arranged that the bundles of tobacco

will come out of the machine in a regular form. The rollers are arranged like the rollers of a copper plate press, except that the upper one is grooved, and that there are guide pieces on the bed of the press which fit into the grooves of the rollers, the space between the grooves and guide pieces being equal to the desired width of a bundle, or hand, of tobacco.

Claim.—“What I claim as new, and desire to secure by letters patent, is the combining of the guard, or guide, pieces with a pair of rollers, one of which is furnished with rectangular grooves; the respective parts being so arranged as to produce the intended effect, substantially in the manner set forth, together with such variations of the same as leave its principle of action unchanged, producing a like effect by equivalent means.”

11. For a machine for *Shaving Shingles*; Simeon Wood, Worcester, Mass., January 15.

In this machine the shingles are shaved on both sides, by means of two shaving knives, that are made to approach each other by two sets of cams that act on arms projecting from the stocks of the knives. These two sets of cams are arranged on the shafts of two cam-formed rollers that draw the shingle through between the knives; they are so formed as to hold on to the wedge formed shingle equally from butt to point, and, therefore, they must have the form of a volute; the cams that act on the knives being of the same form. The ends of the stock of the under knife turn down at right angles, and work up and down freely in the frame, and are hollow to receive freely the turned down ends of the upper knife; these resting on helical springs at the bottom, which tend constantly to separate the knives when liberated by the cams. The shingle bolts are fed to the knives by turning rests joined to two endless chains passing over rollers, and these rests are provided with arms that bear on guide ways, to prevent them from turning until they reach that portion of their circuit where they descend, at which time the arms have reached the end of the guide-ways, which liberates the rest, and permits it to leave the end of the shingle bolt, which is then drawn through by the cam rollers.

The patentee says,—“I am aware that a patent has been granted to another person for a shingle machine, in which the shingle is shaved and tapered by means of two knives that are made to approach each other as the shingle passes through, and, therefore it will be understood that I do not claim this as of my invention; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the cams that force the knives to approach each other with the cams that draw the shingle between the knives, substantially as described; and I also claim the described arrangement of the stocks to which the knives are attached, by making the ends of the upper one slide in the hollow ends of the under one,—springs being interposed between their ends to force the knives apart at the end of each operation. And, finally, I claim the turning rests for feeding the

shingles in combination with the chain and guide, for the purpose and in the manner described."

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12. For an improvement on the *Compound Shovel Plough*; Robert Nelson, West Point, Tippecanoe county, Indiana, January 15.

This is for the purpose of separating the ploughs, or drawing them nearer together. The outside ploughs of the gang are attached to a bar on each side of the beam, and jointed to it at the forward end, the back end sliding on a segment bar of iron projecting from each side of the beam. In this way the ploughs which are attached to the back ends of the bars, can be drawn nearer to, or farther from, each other, this being effected by a hand lever having two arms (at right angles to the third arm, or handle,) jointed by means of links to the back end of the two bars, by the turning of which, to any degree required, the distance of the ploughs can be regulated. At the back of the plough-frame there is a notched plate of iron arranged in a semi-circle, (called the "comb,") for the purpose of holding the hand lever at any point required. The claim is limited to the "combination and arrangement of the bars and lever, so as to effect the contraction and expansion of the cultivator, and, in combination with this, the iron comb."

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13. For a machine for *Cleaning Grain*, called the "Centrifugal Smut Machine;" Meredith Mallory, Mount Morris, Livingston county, New York, January 20.

This machine consists of two disks, one permanent, and the other movable, provided with several rows of teeth, commencing at about the middle of their semi-diameter, and extending to their periphery. The diameter of the rotating disk, which is the under one, is less than the upper, or permanent, one, which is provided with two, or three, rows of teeth beyond the periphery of the rotating disk. There is a fan attached to the shaft of the rotating disk, and the whole is enclosed by a conical case.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of scouring, or cleaning, grain, by causing it to pass from the centre of the revolving disk to its circumference by centrifugal force, said disk being armed with teeth, arranged and combined with an upper stationary disk, furnished with teeth, as set forth. I claim the arrangement and combination of these disks, and also in combination therewith, the fans and curb, or casing, as described."

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14. For improvements in machinery for *Making and Finishing Boat Oars*; Bennett Potter, jr., and Abiather F. Potter, Hubbards-ton, Worcester county, Mass., January 20.

This is a modification of that kind of machines for turning irregular forms, such as gun-stocks, lasts, &c., in which the pattern acts on a guide-wheel, having its bearings on the same carriage as the cutter wheel, which carriage has two movements, one longitudinal to carry the guide and cutter-wheels from end to end, and the other transverse

to enable the guide-wheel to follow the irregular form of the pattern in both directions. In turning oars, which are necessarily of great length, it would be a matter of some difficulty to prevent the pattern from yielding when moving the guide and cutter-wheels. To prevent this yielding, the pattern is made in two parts, the round part being made permanent, as there is no necessity for its turning, the form in the direction of the circumference being regular, and the flat part, or blade, movable, at the junction of the two there is a standard which gives ample support, and is so arranged as to permit the guide-wheel to pass over it as if it were a continuation of the handle part of the pattern. The movable part is rotated by a mandrel in the same manner as the piece of wood from which the oar is to be turned. There is a rest called "bearings," in the specification, attached to a carriage connected and moved with the cutter-wheel carriage, whilst moving along that portion of the oar which constitutes the handle, for the purpose of supporting and steadying the wood whilst under the action of the cutters; but as these bearings cannot pass over the flattened part of the oar at the end of the round part, the latch, which unites the two carriages, is liberated from a holding pin on the cutter-wheel carriage, and is there held until the cutter-wheel carriage returns, at which time the two are reunited, and travel back together.

Claim.—"We claim making the pattern, by which the oar is formed, or against which the guide-wheel acts, of two parts, in such manner that one of the same, or that from which the handle is shaped, shall be stationary, while the other, or part which shapes the blade, shall revolve, the whole being as set forth. We also claim arranging the cutter-wheel and bearings upon separate carriages, for the purpose of arresting the action of the bearings during the operation of the cutters upon the blade part of the oars; the said carriages being connected together, and disconnected from each other by means of a latch and pins."

15. For an improved *Reverberatory Furnace*, for the purpose of directly converting mineral, or ores of iron, into wrought-iron, at the first operation, by the process of puddling; Simeon Broadmeadow, of Manayunk, Philadelphia county, Penn.: assigned to William Green, jr., of Woodbridge, New Jersey, January 20.

[See specification p. 117.]

16. For an improvement in the *Boot Crimp*; Josiah Copeland, of Weymouth, Mass.: assigned to Abraham Thayer, and then to Josiah M. Reed, of Boston, Mass., January 20.

We have here a modification of that kind of boot crimp, extensively used in some portions of the country, in which the leather is stretched by a clamp that holds the corners of the leather, and is drawn out by a screw passing through a nut cut in it, and bearing in a socket in the back edge, or heel, of the form. In this modification the ends of the leather, instead of being clamped on the block, which is drawn out by the screw, is simply laid against the sides of the block which has a

pyramidal form with the base towards the form, and over it is slipped a clasp, which has the sides of the same inclination, and notched, or serrated, when the screw draws out the block, and stretches the leather, this draws the clasp still tighter, and, we are told, that the screw clamp is effectually superseded by this simple arrangement of the clasp.

Claim.—“I do not claim strictly the combination with a pyramidal frustrum, or block, of another piece of metal forced down upon, or over, it by a screw, or other contrivance, separate from the main straining screw, and for the purpose of confining the corners, or edges, of the leather between the said pieces of metal; nor do I claim the forcing of the two jaws, or pieces, of metal together by a screw, or other contrivance, separate from the main straining screw; but that which I do claim, consists in the manner above described, of arranging the block and clasp, so that the turning up of the straining screw shall, at the same time, perform the double operation of confining the ends of the leather between the block and clasp, and of stretching the leather over the boot form; the whole being substantially as above specified.”

17. For improvements in *Self-Setting Head and Tail Blocks*, for setting the log on the carriage of a saw-mill; Thomas C. Theaker, Bucyrus, Crawford county, Ohio, January 20.

The head and tail blocks, under this patent, as under many others that have preceded it, have a slide to which the dogs, &c., are attached, with cogs on the under side, into which the cogs of a pinion take, the arbor of this pinion being placed across the head, or tail, block, so that by the turning of the arbor the slide is moved to one side, or the other. The arbor on both blocks has a segment of a cog-wheel on the end that projects outside the block, which is operated by a vertical sliding rack, and as the segment cog-wheel is connected with the arbor by a ratchet, when the rack is forced up, the arbor is rotated, which operates the slide to set the log, and, on its descent, the segment cog-wheel turns, and carries back the ratchet. On the tail block, the vertical rack is forced up by an inclined plane attached to the floor of the mill; but as it is necessary that the head end of the log should be set quickly, and at the very time the saw passes out of the log, the vertical rack is forced up by a weighted lever, one end of which is jointed to a pitman, that passes through a hole in the floor just under the position of the vertical rack at the end of the back motion of the carriage. The other end of the weighted lever is provided with a cord that passes over a pulley, and is attached to a sliding hook which is disengaged by a pin at the end of the back motion of the carriage, to liberate the weighted lever, which then descends and forces up the pitman and vertical rack; the sliding hook being caught by the carriage at the end of the forward motion, to draw up the weighted lever to repeat the operation.

Claim.—“What I claim is the combination of the vertical rack which operates the slide, the pitman, and weighted lever operated in the manner substantially as set forth. I likewise claim the combi-

nation of the vertical rack, segment rack, (cog-wheel) and ratchet-wheel, operated, substantially, as set forth by the inclined plane."

18. For an improved mode of *Setting the Log on the Carriage of Saw-Mills*; John Miller, Lexington township, Stark county, Ohio, January 20.

This is for setting the tail end of the log, which is, to a certain extent, done in the same manner as in the preceding patent, except that the ratchet-wheel on the end of the arbor is actuated by a lever, instead of a segment cog-wheel, and vertical rack. This lever, instead of being moved by coming against a single inclined bar to move the slide, comes against a succession of inclined blocks jointed to the floor, so that the log is set by a succession of small movements instead of a long one. The inclination of the blocks can be regulated at pleasure by means of wedges that pass in between them and a bed timber designated by the letter T, in the claim, and at the end of this series of blocks there is an inclined piece of timber, designated by the letter U, which conducts the end of the lever over the end of a long spring, to enable it to run back without being caught by the inclined blocks.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the guide-blocks in sections, so as to set the log by several operations of the lever acting on the ratchet-wheel, instead of one operation, in combination with the timbers T and U, and the spring V, the guide-blocks being regulated by wedges, or other analogous devices, all as herein described."

19. For an improvement in the *Planting Plough*; Thomas H. Hoskings, Crawfordsville, Montgomery county, Indiana, Jan. 20.

The patentee says,—“My machine for planting corn is to be so formed, that it may be attached to the common plough, for which purpose it has a projecting arm extending forward, through the end of which a joint pin, or bolt, passes, by which it is so connected with the plough as to keep it in its proper position. The machine has a single wheel which runs in the furrow made by the plough, and on one side of the wheel there is a hopper for containing the corn. A pin on one face of this wheel is brought into contact with a lever which raises a slide on one side of the hopper, and allows the grain to drop out once in every revolution of the wheel. The distance of the hills from each other will be determined, therefore, by the diameter of this wheel.

“What I claim is the manner in which I have arranged the respective parts of said planting machine, so as to connect it with the common plough by means of a joint pin, allowing it to be attached to such plough between the handles, and to be detached at pleasure, in the manner, and for the purpose, set forth.”

20. For an alleged improvement in the *Method of Propelling Boats*; Gabriel Hippolyte Moreau, Paris, France, January 26.

We have here a modification of the well known duck's-foot paddle.

The flaps, or paddles, are jointed to a frame, or frames, actuated by a steam engine, or other first mover, the pivots of the said paddles being near to one edge, and they are held, during their return action, with their plane in the direction of the boat's motion, their widest side abaft; and to insure and expedite their closing at the commencement of the direct action, there is a set of inclined surfaces, or stops, against which their back, or narrow, edges strike at the end of the return, or back, stroke, which causes them to turn slightly, and present a portion of their face to the resistance of the water the moment they commence the direct action. These flaps, or paddles, close against bars in the frame, or frames, which bars slide, and are connected with a bar in the vessel, so that by shifting, and again returning them, after the paddles have been partly turned, the propeller can be made to act backwards, to back the boat when required.

Claim.—“Having stated the nature of the invention, and the manner of making and using the same, I would have it understood that I do not claim propelling vessels by means of reciprocating paddles, but what I do claim, and desire to secure by letters patent, is the method herein described, of causing the paddles at the end of the return stroke to assume a position inclined to the plane of their motion, so that on starting, the resistance of the water shall close them, by the combination of the paddles, or shutters, with the obstacles, or inclined surfaces, for the purpose, and in the manner described, whether the paddles, or shutters, be attached to vertical, or horizontal, axles.” I also claim the shifting of the bars against which the shutters, or paddles, fold, so that the paddles can be made to act in backing the vessel when desired, as herein described.”

21. For improvements in *Steam Generators*; Gabriel Hippolyte Moreau, Paris, France, January 26.

The claim is in the following words, viz.—“I claim making the generator of a series of small horizontal tubes, all on the same plane, in combination with, and opening into a tube of greater diameter, placed at right angles with them, or nearly so, the opening, or connexion, between each tube in the series, and the large tube being equal, or nearly so, to the diameter of the tubes in the series, so that the communication, between the tubes of the series, shall be common for the water and steam. I also claim regulating the feed of the water into the boiler by a floating valve in the feed pipe, the specific gravity of which shall cause it to close the aperture in the feed pipe, when the water reaches the proper level, as described. I farther claim preventing the rush of water from one side of a series of tubes to the other, in marine and other locomotive boilers, by means of a partition disk placed in the tubes, as described. And, finally, I claim regulating the intensity of heat in the furnace, and thereby regulating the generation of steam, by the pressure of steam acting on a piston connected with the damper which regulates the draught of the chimney, in combination with the means described for overcoming the friction of the moving parts in reopening the damper, when the pressure is reduced, as described.”

The first claim needs no explanation. The second item claimed consists of a valve in the induction pipe, which is attached to a float in such manner, that when the water has reached the high water mark, the valve rising with the float, closes the valve, which cannot open until the water sinks in the boiler; this valve is placed in a vertical tube by the side of the generator, and constituting a part of the supply pipe. The third item claimed, consists simply in placing a disk in the tubes which compose the generator, which disk is of less diameter than the inside of the pipe, and which, therefore, does not prevent the flow of water and steam, but which presents sufficient impediment to the motion of the water, as to prevent a sudden rush of the water from one end to the other by the sudden careening, or pitching, of the boat. And, finally, the mode of regulating the draught of the chimney is by connecting the damper of the chimney with a piston, acted upon by the steam in a cylinder, by means of a lever which extends beyond the piston, and is there provided with a box, or vessel, having a valve at the bottom; when the piston is forced up by the pressure of the steam, the extremity of the lever opens a valve in the bottom of a reservoir of water, which runs into and fills the vessel at the end of the lever, the weight of which, after the steam has reached the gauged elasticity, overcomes the friction of the piston and other moving parts, forces down the piston, reopens the damper, and opens the valve at the bottom of the vessel which discharges the water, and puts the apparatus in readiness to act again, should it become necessary.

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22. For an improvement in the *Plough*; William K. Allen, Brownsboro', Oldham county, Kentucky, January 31.

This plough is made altogether of iron; the standard is jointed to the land side, and connected with the mould-board by a setting screw bolt. The beam is jointed to the top of the standard, and the back end, which is slotted, is connected with the handles by a setting screw bolt; and then two links are jointed with screw-bolts to the lower end of the handles, the standard and beam.

Claim.—“I make no claim to the individual parts of the plough, nor to making it entirely of iron; but all that I do claim, and for which I ask letters patent, is the adjustable plough stock, in combination with the adjustable handle, as set forth.”

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23. For an improved *Ointment for the Cure of Piles*; Wm. Willshire Riley, of Mansfield, Richland county, Ohio, January 31.

The following are the instructions contained in the specification:—“Take of the cream of sulphur two ounces, of powdered nut galls one ounce, of powdered opium one grain, and mix them intimately, adding lard enough to give it a proper consistency for ointment, mixing it thoroughly; which is to be applied to the parts affected as often as twice every twenty-four hours, until a cure is effected: all of which I claim as my invention, and desire to secure by letters patent.”

24. For a machine for *Forging and Swaging Anvils*; John Taylor, Shade Gap, Huntingdon county, Pa., January 31.

The swages in this machine, as in all others, are made one movable, and the other permanent; the latter is called, in the specification, the bed: the two are so formed as to give to the anvil, when completed, the required curves, and to prevent this operation from forcing the surplus metal to the face, and rendering it uneven, there is a vertical rest, which is a continuation of the bed, against which the face of the anvil to be acted upon is placed. After the proper curves have been given to the anvil, it is secured in a double screw clamp jointed to the floor, and on each side there is a common anvil placed at such distance from the clamp, that the two sides can be forged alternately, without removing the anvil from the clamp.

Claim.—“I make no claim to the frame, hammers, and guides. What I claim is the bed on which the anvil is formed, shaped to correspond with the required form of the anvil, in combination with the vertical face, rest, or gauge, as set forth. Likewise, the jointed clamp in combination with the side rests, or anvils.”

25. For an improvement in *Filters, used in the Manufacture of Sugar*; John Watson, Chorley, England, January 31; patent to run fourteen years from the 23d of June, 1842.

This filter is composed of two concentric, perforated, conical, or cylindrical, vessels, made of wire cloth, or other porous material, with the space between the two filled in with animal charcoal. The vessel, thus constructed, is closed at the top and bottom. The liquid to be filtered is introduced by a pump through the bottom, which is also provided with another tube for discharging the contents when needed. When it is required to apply pressure to the liquid, there is a third tube passing out through the bottom, and turned and carried up to receive a column of liquid high enough to give the required pressure.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is, first, employing animal charcoal for filtering purposes between two vertical surfaces (or nearly vertical) of wire cloth, or other porous material, the liquor to be filtered entering the charcoal through one of the vertical surfaces, and escaping from it through the other, as set forth; secondly, I claim the method of constructing my apparatus by forming it of two vessels, one within the other, having animal charcoal in the space between them, said vessel being constructed and operating, as set forth.”

26. For a new compound, or paint, denominated “*the Indestructible Carbonic Paint* ;” Joseph Weisman, Philadelphia, Pennsylvania, January 31.

The patentee says,—“The nature of my invention consists in combining the metal of carbon, or purified graphite, with caoutchouc and shellac, together with a small portion of acetate, or sugar, of lead; the ingredients being mixed with linseed oil and spirits of turpentine.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the combination of carbon, or pure graphite, with caoutchouc and shellac, together with acetate of lead, linseed oil, and spirits of turpentine for the purpose set forth, forming a perfectly indestructible anti-corrosive pigment, which also serves the purposes of anti-attrition.”

27. For an improvement in *Ships' Blocks*; Stephen Waterman, Greenwich, Conn., and D. Russell, New York city, January 31.

This improvement consists simply in putting the metal strap used on ship blocks, on the inside, instead of the outside, of the cheeks, so that these straps are directly against the sides of the sheave, thus shortening the bearings of the pin which may, therefore, be reduced in diameter.

Claim.—“What I claim is constructing the blocks in the manner described, with the straps passing down through the shell on the inside close to the sheave, in the manner and for the purpose described.”

RE-ISSUES OF PATENTS.

1. For an improvement in *Gun Locks*; Ethan Allen, late of Grafton, Mass., now of Norwich, Conn., January 15, date of patent November 11, 1837.

As this patent was re-issued for an amendment of the claim, we will simply give the new claim, and refer the reader to vol. xxii, of this Journal, 2d series, for a description of the lock.

Claim.—“I do not claim the several parts of the lock separate from each other, as in my surrendered patent, but that which I do claim consists in the combination with the trigger, or sear thereof, and the cock, or tumbler, thereof, of the apparatus by which the cock is elevated from the cap, or nipple, and discharged, or permitted to descend thereon, by the force, or reaction, of the main spring whenever the trigger is retracted by the finger; the said apparatus consisting of the dog, or catch, jointed, or hinged, or otherwise suitably applied to the tumbler, or cock, or to the trigger, as the case may be, the same being operated by the trigger, or by the same and other parts, and constructed, substantially, in the manner set forth.”

IMPROVEMENTS ADDED TO EXISTING PATENTS.

1. For an improvement in the machine for *Breaking and Screening Coal*; Joseph Battin, Philadelphia, Penn., January 20, added to a patent granted Oct. 6, 1843.

The patentee says,—“In the specification to which this is supplementary, I described two rollers having teeth upon their peripheries for the breaking of the coal, these rollers being geared together, and operating as described in said specification. I have since found that this part of the process is much facilitated by the addition of a third,

or auxiliary, roller, of smaller diameter than the two at first used, and placed above them. What I claim therein as new, and desire to secure by letters patent, is the combining the third, or auxiliary, roller, with the machine for breaking and screening coal, as patented by me on the 6th of October, 1843. It will be manifest that a second pair of rollers might be used instead of the auxiliary roller, but these would require more power to move them, and would not perform their office any better than the single roller."

List of American Patents which issued in the month of September, 1841, with Remarks and Exemplifications. By CHARLES M. KELLER, Examiner of Patents.

(Continued from Vol. IV, 3rd Series, p. 279.)

1. For an improvement in the *Rotary Pump*; Samuel A. Lee, Boston, Mass., Sept. 4.

We make the following extracts from the specification, viz.,—"The outer part of this pump consists of a stationary drum of cast-iron, or other metal, which is to be placed firmly upon any stationary stand. Within this drum there is a central shaft, which is sustained by the two heads of the drum, said heads forming the bearings within which said shaft revolves. Attached to this shaft there are two disks, or round plates, of metal, which, when in place, stand, respectively, at the distance of about an eighth of an inch from the heads of the drum, and their edges reach to within about the same distance of the interior of its periphery. The space between these disks constitutes the chamber into which the water is to enter from the reservoir, and from which it is to be forced by the revolution of the shaft and disks, and by the action of a cam and valves, so constructed and arranged as to effect that object."

"The water is to enter the chamber of the pump through the revolving shaft, which is made hollow for that purpose, being bored out from one end to a depth which shall cause said opening to extend within the shaft to the line of the further side of the chamber between the two disks. A water-way is then cut from said hollow shaft into the chamber, and this water-way is covered by a valve within the chamber; which valve, when closed, will prevent the return of any water from the chamber into the lower supply pipes. Between the two revolving disks, constituting the sides of the pump chamber, there is a cam consisting of a curved piece of metal which extends from the shaft to the edges of the disks, and which fills the space between these disks, extending from one of them to the other. The convex side of this cam is covered with leather, which extends to its outer edge, and there comes into contact with the rim of leather which lines the periphery of the drum; this cam might be denominated a revolving piston, as it serves to draw the water from the reservoir, and to force it up to the point where it is to be delivered. The convex side of this cam serves to raise a valve, which, when not so raised, occupies the chamber, and forms a partition across it, extending from the

shaft to its outer rim, and which, when raised up by the cam to allow it to pass, is received within a semi-circular valve chamber, on the upper side of the drum, from which chamber the delivery pipe proceeds. . . . The edges of this valve are leathered, so as to cause it to work water-tight between the sides of the chamber of the pump, and those of the valve chamber above."

"What I claim therein as my invention, is the manner in which I have constructed, arranged, and combined the hollow revolving shaft, the revolving disks and cam, or piston, attached thereto, and the segmental valve, with the chamber into which it is raised by the cam, in the manner set forth, so that these parts, with their appendages, will co-operate with each other in producing the intended effect, substantially as described."

2. For an improved *Suspender Strap*, to be attached to pantaloons; David B. Cook, New York, Sept. 4.

The patentee says,—“The nature of my invention consists in attaching to the waist, or waist-band, of the pantaloons, a strap to be made of broad cloth, India rubber webbing, or any other material the pantaloons may be made of, about eight inches in width, where it is attached to the pantaloons, two inches from the front of the waist-band of the pantaloons to the back of the hip seam, and gradually tapering off to about one inch in width, where it meets, and is attached to the suspender buckle attached to the strap. What I claim as my invention, and desire to secure by letters patent, is combining the suspender with the waist, or waist-band, of the pantaloons by means of the strap attached to the pantaloons, as herein described.”

3. For improvements in the *Lamp* for burning lard and other concrete fats; George Carr, Buffalo, Erie county, N. York, Sept. 4.

This improvement consists in making the metallic conductors, or heaters, heretofore used in lamps for the combustion of the concrete, or partially concrete, fatty materials, hollow and so arranged as to heat them, and the air they contain. For the argand lamps the inner deflecting button, with its sustaining stem, are hollow, and at the bottom communicate with a tubular air space surrounding the wick tube, and from this a flat tube extends into the reservoir of lard, &c. This method of heating, or liquifying, the fatty materials, is described as applied to a series of lamps with the common burner. The lamps with their lard reservoir, rest on a hollow air vessel which extends up and surrounds them, so that the heated air may extend entirely around the vessels containing the lard, &c. This air vessel is to be heated by means of an auxiliary lamp below.

Claim.—“I do not claim to be the first inventor of lamps for this purpose, or of using conductors of metal for rendering the concrete materials liquid, by conveying heat thereto from the flame of the lamp; but what I do claim as of my invention, and desire to secure by letters patent, is the employment of hollow, or tubular, conductors,

within which the air is to be heated, and which hollow conductors, so containing heated air, are to surround, or to be surrounded by, the burner containing the wick, in lamps of the argand kind, and are to extend also into the reservoir, for the purpose and in the manner described. I likewise claim the applying of the heated air vessels, as modified and described; the said apparatus, under every change of form, being so constructed as to operate upon the concrete materials by the combined influence of good metallic conductors, and of heated air, and, substantially, in the manner made known."

4. For a *Horse Power* for driving machinery; Moses Davenport, Pittsburg, Allegheny county, Penn., Sept. 4.

This horse power is constructed on the general principles of the sun and planet motion. The main wheel is a permanent ring with cogs on the inner periphery, into which mesh two traveling pinions that have their bearings in the sweep plate, turning on a central shaft, and drawn by the horses. On the shaft of each of these pinions there is attached a driving wheel, which meshes into a central pinion, and as these two wheels are on opposite sides, they balance it in its bearings. The central pinion is mounted on a shaft having the belt wheel near the bottom, the shaft turning on a pivot at the bottom of the frame, and being sustained at the top partially by a support which extends across the frame, and through which it passes. This support is between the central pinion and the belt wheel, on the lower end of the same shaft. The sweep plate has a hollow cylinder in the middle, in which the central pinion rotates; its sides being so much cut out as to enable the driving wheels on the traveling pinions to reach and mesh into this pinion: and the under side of this hollow cylinder is so formed as to fit and run in a channel made for this purpose in the upper part of the support for the central shaft. In this manner the several moving parts are kept at proper distances apart, and are free to rotate. The sweep frame is supported on the outside by rollers traveling on the rim of the main wheel.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the hollow cylinder attached to the sweep plate, having openings through which the driving wheels communicate motion to the (central) pinion working within it, for the purpose and in the manner described. And I also claim the support (having a channel for the reception of oil, into which works the lower part of the hollow cylinder,) in combination with the hollow cylinder, for the purpose and in the manner specified."

5. For a mode of making *Berths for Vessels*, which answer the purposes of a *Locker*; Harmon King, New York city, Sept. 11.

The object of this improvement is to arrange a berth front to the top of a locker situated along the side of a vessel, or in front of, and below the usual berths, in such manner that the front of the berth can be thrown back to get at the inside of the locker with facility, or to use the top of the locker for a seat. The movable front is attached

to two metal arms that pass through slots, or holes, cut in the top of the locker, and are hinged, by means of a rule joint, to the bottom of the locker. There are covers fitted to the arm-holes, or slots, in the top, which fit in to hold the arms when thrown forward, or back.

Claim.—“I do not claim as my invention any of the separate parts of the vessel’s berth; but what I do claim as my invention, and wish to secure by letters patent, is the combination of the movable berth front aforesaid, with the metal arms, hinges, or rule joints, arm holes, covers, &c., in the manner herein described, or in any other substantially the same, so that a good and proper berth may be readily and expeditiously adapted for use upon that which appears to be, and is, used for an ordinary seat, or locker.”

6. For manufacturing *Seamless Hats, &c., of Leather*; James S. & William Wibirt, Buffalo, Erie county, N. York, Sept. 4.

A piece of leather of the required size, is put on the top of a hat block, and bent down, and a string passed over it to hold in the folds which are then to be rubbed in, whilst in a moist state, with a scouring iron, or tool, until the body of the hat is formed, and the rim spread out. After the hat has thus been formed and dried, it is to be rendered water-proof by a composition of linseed and neats foot oils and caoutchouc, and then colored and varnished.

Claim.—“We do not claim, as our invention, the well known process of crimping leather into various forms, as this has long since been known; nor do we claim the making of hats and caps of leather, as this has been done by sewing the parts together, so as to give the form required. What, therefore, we claim as our invention, and desire to secure by letters patent, is the new fabric described above, consisting of hats and caps, and hat and cap bodies made of leather without seam.”

7. For an improvement in the *Steam Engine*; William Whitham, Huddersfield, England, Sept. 4.

The object of this improvement is to work steam expansively in one portion of the engine, after it has acted by high pressure in another part, in direct communication with the boiler, as in the Woolf engine, except that in this engine the object is sought to be attained by one piston instead of two, so that the force of the steam, as the patentee states, is employed, “first, by high pressure, second, by expansive pressure, thirdly, by condensation.” The piston, which works in a cylinder, has its upper surface reduced by a cylindrical case which surrounds, and is connected with, the piston rod, and which passes through a stuffing box in the head of the cylinder. The upper surface of the piston being thus reduced, and the whole of the under surface being retained, the steam passages and induction and eduction valves are so arranged, as to admit the steam directly from the boiler to the upper surface of the piston, and after it has forced the piston down, it is admitted to the under and large surface, and there acts by

expansion upon so much of its surface as the area of the under surface is greater than the area of the upper surface, for the rest is neutralized, the pressure being as great above as below, on equal surfaces.

Claim.—“What I claim is the combination of the peculiar piston within a steam cylinder, having suitable steam ways and slides, or valves, by which the steam, having acted by high pressure on one side of the piston, may pass into the cylinder on the other side of the piston, and act by expansive pressure on the larger area of the piston, and thus produce the return stroke of the piston, as described.”

The engineer, in considering this, will wonder at the waste of ingenuity, time, and money, to effect what is so much better done by the simple cut-off now so extensively applied.

8. For an improvement in the *Augur for Boring Artesian Wells*; William Morris, Kanawha county, Va., Sept. 4.

The object of this improvement is to prevent, as much as possible, any injury to the pole, or bar, to which the bits, or drills, used in boring artesian wells, are subjected when the bit, or drill, strikes the bottom. The bit, &c., is attached to a heavy sinker, to insure its descent, and increase the force of the blow, and the sinker is connected with the pole, or bar, by means of a sliding joint, so that when the bit, &c., strikes the bottom, the sliding joint eases the jar which the pole would otherwise receive.

Claim.—“What I claim as my invention, is the method of uniting the bit, &c., with the sinker, by means of the sliding connection, substantially as herein described.”

9. For an *Improved Apparatus for Supplying Water to Steam Boilers*; John Hampson, New Orleans, La., Sept. 4.

In the upper part of a boiler is fastened a steam pipe, with a seat for a valve that opens downwards by a lever, to which is jointed a float that rises and falls with the surface of the water in the boiler. A rod passes through a stuffing box in the upper part of the boiler, and just over that end of the lever to which the float is attached, to enable the engineer to open the valve at pleasure. By this arrangement this valve can be opened from without, but cannot be closed except by supplying a sufficiency of water to the boiler. The pipe to which this valve is attached, extends up to a small vertical cylinder open at both ends, and made fast to a steam-tight cistern, or reservoir; near the lower end, and within the cistern, the cylinder is pierced with two small holes to admit steam from the boiler to the upper part of the cistern, and near the upper end it is also pierced with another hole to admit steam to a whistle. Within this cylinder there are two pistons connected together, at such distance apart, that when the lower one is below the holes that admit steam to the cistern, the one that leads to the whistle is closed, and *vice versa*. These pistons are connected with an ordinary valve in a water-pipe leading from the bot-

tom of the cistern to a reservoir of water by two bars; the surface of the lower piston is as much greater than the valve as to have the surplus pressure on their surfaces balance and overcome the weight, friction, &c., of the moving parts. There are two hangers attached to the bottom of the cylinder that extend down to about the middle of the cistern, and sustain a bolt that guides the bars that connect the pistons and valve, and form the fulcrum of a lever "formed like a cross hilted sword," placed between the two bars—the fulcrum being at the junction of the cross. To the bolt is jointed two spring hook catches, one up and the other down, that alternately engage and hold on to studs, or pins, in the before mentioned bars, for the purpose of holding the pistons and valve up, or down, as may be required. The long end of the cross lever is forked and jointed to a collar on a float that slides up and down on a rod extending from the bottom up, and through the top of the cistern, and the short arm is provided with a counterweight which balances half the weight of the float when out of the water; and the cross arms of this same lever act on the spring catches.

The cistern communicates with the boiler by a pipe from the bottom of the former, and passing through the top of the latter, and extending down below the low water mark. In this pipe there is a valve opening downwards, and attached to a lever having a float. A discharge pipe at the bottom of the cistern is provided with a cock. The operation of this apparatus is as follows, viz.—"When the water becomes too low in the boiler, the first described float sinks, opens the valve connected with its lever, and steam passes up the pipe, and from thence into the cistern through the two holes in the cylinder, until its pressure is sufficient to force up the pistons which cut off the steam, and opens the passage to the whistle, or alarm—the lower stud pin, on the bars of the pistons, is caught by the lower catch on the cross lever, which prevents the pistons from descending. This same operation opens the valve in the water, or supply pipe, down which the steam passes, and is condensed, and then the water from the main reservoir is forced up into the cistern, by atmospheric pressure; when the supply of water in the cistern is sufficient, the float on the end of the cross lever rises, liberates the piston and valve bars from the catch, and the valve in the supply pipe is immediately closed by the pressure of the atmosphere on the upper one of the two pistons. As soon as these have descended, the upper stud pin is caught by the upper spring catch, steam is again admitted to the upper part of the cistern, which establishes a balance of pressure in the boiler and cistern, the weight of the water then opens the valve in the pipe that connects the two, and passes into the boiler. The discharge of the water from the cistern leaves the float on the cross lever suspended, the weight of which disengages the catch from the stud pins; the steam then forces up the pistons, and thus leaves the apparatus in a condition to act again.

Claim.—"What I claim is the particular manner in which I have combined the float and valve of the boiler with the reservoir and boiler, and the passages connecting them, by means of a cylinder and

pistons of peculiar construction, and the apparatus connected therewith; and also combining with the same the float and lever within the reservoir, and the tube for supplying said reservoir with water, so as to produce a self-acting apparatus both for supplying the boiler and reservoir with water; that is to say, I claim, first, the combining with the reservoir which receives the water for supplying the boiler, the connecting tube, the cylinder, the pistons, the bars, and the valve, constructed and operating substantially as set forth; second, the combining with the foregoing apparatus the float, lever, and valve within the boiler, for admitting steam into the tube on the descent of the float, the pipe for supplying the reservoir with water, and the tube for conducting it into the boiler; the whole being constructed and operating as described; third, I claim the mode of governing the supply valve, and regulating the admission of steam into the reservoir, by means of the lever, provided with a float and a counterbalance, and furnished with catches, as set forth, and combined with the bars, having studs, or pins, to which said catches are adapted, in the manner and for the purpose herein described; fourth, combining the whistle, or alarm, with the cylinder, steam pipe, and pistons, as set forth, for the purpose of giving an alarm when the water is low in the boiler."

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10. For an improved machine for *Shrinking and Napping Hat Bodies and Cloth*; Henry A. Wells, New York city, Sept. 11.

This machine consists of a double case, of a cylindrical, or other, form, hung upon journals in an appropriate frame. The hat bodies, or felt cloths, are put in the inner case, and in the commencement of the operation steam is admitted to the inside through a hollow gudgeon, so that steam is discharged on to them whilst they are worked together by the rotation of the apparatus; and afterwards this supply of steam is cut off, and steam, or heated air, is admitted through the other gudgeon into the space between the two cases. It is preferred that the inner case be polygonal, the better to work the hat bodies, or cloths, within.

Claim.—"The principle of this improvement, which I claim as my invention, consists in the mode of operation whereby the material to be shrunk, contracted, or felted, with rapidity and evenness, is subjected to the direct action of steam, and afterwards only to a dry heat in a double vessel, kept all the time in motion, so that the material may be exposed on every side to the action of the steam, or heat, during the operation, as aforesaid. It is obvious that an outer and inner vessel, of any form and dimensions, may be used, and yet the principle be the same. I have described the form I prefer; but I claim, as my invention, the use of any mechanical means operating substantially in the same mode to produce the same effect."

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11. For an improvement in the manner of *Supporting and Arranging Grates in Stoves, &c.*; Gardiner Chilson, Boston, Mass., Sept. 11.

This grate, which is represented as elliptical, and adapted to a stove

of the same form, is hung on journals placed a little to one side of the longitudinal axis, so that more than one half of the surface of the gate shall be on one side of the line running through journals. The widest side of the gate rests on two supports, or projections, from the inside of the stove, so that the coal in the grate, being more on one side of the axis of rotation than on the other, prevents it from turning, except when force is applied to one of the journals that passes through the side of the stove, and is there adapted to receive a hand lever for this purpose.

Claim.—“I claim, as my invention, extending one of the journals of the grate through to the outside of the stove, and by means of a lever inserted thereon, in combination with the projections, above mentioned, obtaining an easy process by which the ashes may be shaken, or sifted, from the coal, and the coal may be removed from the grate, while the same is entirely closed; the whole being constructed and operating, substantially as above specified.”

12. For improvements in *Salting Animal Matters*; Charles Payne, South Lambeth, England, Sept. 11.

The object of this improved apparatus is to apply brine to animal matter in an exhausted vessel. At the bottom of the receiver there is a perforated plate on which the material is put, and on the top of it is put another perforated plate. The bottom of this receiver is provided with a discharge pipe and cock, and the upper part is in connexion, on one side, with an air pump, provided with a gauge for indicating the vacuum, and on the other with the vessel containing the brine—there being an air-pump and safety valve between them. The animal material being put into the receiver, the communication with the brine vessel is closed by an air-tight cock, and that with the air-pump is opened. When a vacuum of about twenty-seven inches is obtained, the stop-cock on that side is closed, and the one leading to the brine vessel opened, and the brine is immediately forced into the receiver by atmospheric pressure. When the receiver is filled, the force pump is set to work until the required pressure in the receiver is indicated by the safety valve; the meat is then suffered to remain under this pressure for about fifteen minutes, and then taken out.

Claim.—“What I claim is the mode of preserving animal substances by means of a vessel (receiver) combined with an air-pump for exhausting it, and a reservoir containing brine, the whole being constructed and operating in the manner set forth. Also, the method of constructing the receiver with a false bottom perforated with apertures in combination with the pressure-pump, for forcing the brine through the animal matter.”

(To be Continued.)

NOTE BY THE EDITOR.

It will be seen by the caption of the foregoing analytical list of American Patents, that it is drawn up Mr. C. M. KELLER, Examiner

of Patents in the United States Patent Office. Such had been the case for about eighteen months prior to suspending the publication of said lists; but animadversions were then occasionally added by the editor, in his revision of them. They will, hereafter, be published without such addition, excepting when specially noted, the whole duty of their preparation devolving upon Mr. Keller, who deems it incompatible with his official station to remark upon the merits, or defects, of the respective patented inventions. The editor is aware that this list has constituted a leading feature of the Journal of the Franklin Institute, and many inquiries have been made into the cause of its discontinuance; it is not thought necessary to enter into particulars on this subject, and it will suffice to say, that the income from the Journal has never covered the expenses of its publication; that when its fiscal concerns were transferred to the Institute, the editor had expended several thousand dollars on its establishment; and that, without taking into account the value of eighteen years labor, he has not received the amount of his actual expenditures. The Institute would willingly have paid him liberally, had it possessed the means; but it has had to divert funds, derived from other sources, to the sustaining of the Journal, and the labor now bestowed upon it by the Editor, like that of the Collaborators, and of the Committee on Publications, is given without charge. This state of things may excite surprise, as the Journal is extensively diffused; still, however, the number published is but small, compared with that of many other periodicals, a single copy being, in many instances, subscribed for by large manufacturing establishments, and deposited in their reading rooms.

It is the intention of Mr. Keller to supply, every month, an analytical list of a portion of the patents that have passed during the period that has elapsed since their publication was suspended, and to continue this until the hiatus is filled, the Institute having made arrangements with him for that purpose; and the editor will also publish many of the specifications, drawn up by him in the regular course of his business, as agent of applicants for patents.

T. P. J.

ENGLISH PATENTS.

Specification of a Patent granted to WILLIAM NEWTON, of the county of Middlesex, for certain improvements in the preparation of Paper, designed for Bank Notes, Government Documents, Bills, Cheques, Deeds, and other purposes wherein protection and safety from forgeries, or counterfeits, are required.—Sealed June 10th, 1843.

The improvements in the preparation of paper designed for bank notes, government documents, bills, cheques, deeds, and other purposes, wherein protection from forgeries is required, consist in covering both sides of the paper used for the above objects with designs,

arranged and printed in such a manner that they cannot be imitated by the hand of man, or the agency of machinery, nor transferred upon stone, and then reproduced by any of the means known in lithography.

It is a well known thing, that stamped paper used for deeds may be washed, and used again for other deeds; the government stamps being preserved un mutilated, and that part of the writing may be taken out, and other words substituted; also that figures and indications of sums of moneys may be altered by chemical processes, the stamp remaining entire, as well as the body of the document.

Now the present invention has for its object, firstly, to render it impossible to wash out any portion of the writing, and substitute other words. Secondly, to guard against any partial alteration made in the tenor, or wording, of the deed, or other document, for fraudulent purposes. Thirdly, consequently to increase the revenue of the Stamp Office, by preventing the possibility of stamped papers being used more than once. Fourthly, to give to commercial purposes all the security required.

The designs printed on the surface of the paper, and on each side thereof, must be so organized as to render it impossible, first, to imitate the matrix, or mother plate, from which the design is obtained. Secondly, to trace, or copy, by hand all the elements, or parts, of the design with lithographic ink, for the purpose of transferring it upon stone; and thirdly, to transfer the whole design on to lithographic stone, and from which proofs may be afterwards taken.

These results are attained by the improvements forming the object of the above in part recited letters patent, for the perfect intelligence of which, I shall describe the nature of the paper to be used, the designs to be employed, the mode of organizing and engraving them, the printing of the same, and the nature of the inks.

Choice of Paper.—The paper used for deeds and documents of all kinds, must be of such a kind, or nature, as to present all the requisites of durability. Two sorts of paper are manufactured, the one made by the hand, and called “hand made,” the other made by a paper machine, and called “continuous, or machine made paper.” The manufacturer of continuous, or endless, paper cannot conveniently use pulp, powdered by mallets, or beaters, as is the case for paper made by hand, the fibres of such pulp being too long to drain on the endless wire cloth. From hence arises the necessity of using grinding cylinders of great power, in order to convert the rags into a very fine pulp. As a necessary consequence, the continuous, or machine made, paper is of a finer quality, but is not so strong as the hand made paper.

The papers, the pulp of which has been bleached by chlorine, ought not to be used for making a safety paper, that is to say, paper presenting all the above mentioned conditions, for the chlorine weakens the pulp, and opposes obstacles almost insurmountable to the making of safety paper.

Papers manufactured in this manner, however carefully they are made, always retain certain chemical agents, which, after a time, act

upon, and eventually may possibly destroy, the vegetable substances used for coloring the inks. It is known that on some papers manufactured in the above manner, the writing becomes obliterated and illegible in a very short time.

It is, therefore, of the utmost importance in the production of safety paper, to employ only paper manufactured by hand, with rags naturally white, and not bleached by chlorine. This observation has only for its object the production of a paper of the greatest possible durability, and not containing any chemical agents likely to attack the ink; but the improved method of preparing paper for all the purposes above mentioned, may be applied to continuous, or machine made, paper, in the same manner as to paper made by hand.

Nature of the Design.—It is not sufficient that the design engraved should be difficult, or impossible, to copy, it is also necessary that any falsification may be easily detected, and that the subscriber of a promissory note, the drawer of a bill of exchange, or any one else, should be able at a single inspection of the documents, to ascertain whether the design has, or has not, been reproduced by hand, at the place where the amount of money is generally written, without being under the necessity of bringing another bill to compare therewith.

The design must, therefore, be composed of regular parts, easily perceptible, and recognizable by the naked eye; but it is essential that the type, figure, or device, be geometrically regular, and present a great purity and distinctness in the lines, and a great symmetry in the disposition of its constituent parts. In its composition there should be no straight lines, because they are too easily made with a rule, nor any curve which may be traced at once by a compass. The imitation of this regular element must oppose insurmountable obstacles to forgers.

These regular elements are to be distributed symmetrically on the whole surface of the sheet of paper, and must be repeated a great number of times, to offer a great number of points of comparison.

What has been stated with reference to the disposition of one of the regular elements taken individually, applies equally to the whole of the elements constituting the design.

It is, therefore, indispensable, in order that these regular elements may be inimitable by hand, that they should be distributed on the surface of the paper with a mathematical precision, so as to offer an uniform tint; they are, consequently, to be engraved and distributed on the surface of a matrix, or mother plate, in steel, or other metal, or on stone, by the agency of a machine. A regular element, or design, must, therefore, be mechanically produced, and repeated identically, and at regular intervals on a given surface, so that the most skilful hand, assisted by the most keen eyesight, and the most obstinate patience, will find it impossible to reproduce one of those elements if it were obliterated.

The same impossibility would exist with reference to any attempt made to charge the whole of the lines constituting the regular element with lithographic ink, in order to transfer them on to stone, and strike off proofs from the same.

The design produced in the manner above described could not be imitated by hand, but might be, by mechanical means, and as a guarantee against that contingency, I have recourse to the following contrivance:—

The spaces left between the regular elements are filled up by a design of a different aspect and description, but no confusion with the regular elements must take place; and, moreover, this design, as an indispensable condition, is produced by chance, so that it is impossible to obtain two similar drawings by using the same means, or any other; the latter design is microscopic, that is to say, the elements constituting it can only be properly seen by means of a magnifying glass. The second design produced by accident, and not imitable, has, for its object, to render the counterfeit of the matrix, or mother plate, impossible, and also the washing of stamp papers which have been written upon, and the reproduction of another design.

Organization of the Designs.—A matrix, or mother, design composed of regular elements in the condition above stated, is to be engraved by means of a point, and a suitable engraving machine, or by any other method of producing the same result capable of engraving a given device, or design, *ad finitum*, and with the greatest precision. This design may be engraved, or marked, on a lithographic stone, or even on a block of wood; but a steel plate is preferable, as this description of work requires great precision.

A proof is taken from this plate in the ordinary manner of copper-plate printing, and transferred on to the lithographic stone by the means now known and employed by lithographers. The transfer being thus made, I then, by means of a brush, and gum arabic dissolved in water, and slightly colored, or any other substance soluble in water, cover all the regular elements constituting the design transferred on to the stone. This covering, which is not applied over the intermediate spaces left between the regular elements of the design is allowed to dry. Then a second drawing is transferred on to the whole of the same stone, this latter drawing being composed of irregular elements much smaller than the regular elements of the first drawing, and which may be microscopic.

It will be understood that the regular elements being protected by the gum covering, and the intermediate spaces alone being left, it is only on the latter parts that the stone will receive the second drawing.

This drawing is previously to be made on a sheet of metal, or stone, or even on wood. It may be etched and engraved by the hand, by machinery, or by a chemical process; but whether made on a metal plate, on stone, or by a lithographic operation, it must necessarily be obtained by chance, so that it cannot be reproduced, either by the process that effected it, by any other process, or by the hand of an artist.

I shall point out, by way of illustration, some of the means which may be employed to attain this result.

One may take resin, or colophony, in powder of a middling fineness, and sift it on to a lithographed stone previously heated. When the grains, or atoms, of resin are fixed by the heat, the stone must be

corroded by a solution of nitric acid, and thus an irregular ground is obtained.

The size of the grains of resin, the degree of heat necessary to be given to the stone, in order to fix the said grains, as well as the strength of the acid employed for the corrosion, must vary according to the results to be obtained.

One may also make an irregular ground on a lithographic stone, by taking a brush with short hairs, or bristles, dipping this brush in thickened lithographic ink, and striking gently, or irregularly, on the surface of the stone with the extremity of the brush, the ink thus laid on the stone is to be fixed by the ordinary process.

One may also cover a lithographic stone with lithographic ink, which is allowed to dry, then, on the whole of the blackened surface, an engraver's roller is to be rolled irregularly to obtain white points on a black ground.

The above are only a few of the many modes which may be employed to produce an irregular ground.

It must be understood that the owner of this plate may take proofs from the same, transfer them on to stone that he may take casts from it, cause it to be reproduced by the polytype and electrotpe process; but neither the author himself, nor any other person, could make a second plate identical with the first, except by some of the above means of multiplication.

The irregular ground being obtained by one of the modes above stated, or some mode equivalent, I take a proof from the plate, and transfer it on to the lithographic stone which has received the regular drawing, as above stated.

The transfer being made and fixed on the stone, I remove the gum by which the regular elements have been covered, and then I can have lithographic impressions, on which may be distinguished, by the naked eye, the regular elements surrounded, but not covered by irregular and microscopic elements.

Instead of composing the matrix, or mother plate, by transfer taken from two separate plates, this object may be effected by executing on the same plate on which the regular design has been already engraved, and by any of the means above indicated, or by any other appropriate mode, the irregular design forming the ground, so as to obtain a mother plate without transfer.

The matrix, or mother plate, thus obtained, twenty, or a greater number of plates should be produced, in order to guard against any accident which might happen to the matrix, or mother plate.

These plates, which I shall call *seconds*, are obtained by taking proofs from the mother plate, transferring them on to stone, and fixing them thereon.

From the *seconds* impressions are taken, and that may be done *ad infinitum*; these proofs are transferred on to lithographic stone, the lineaments are brought up in *relievo* by the ordinary process of engraving upon stone, and then the impression may be produced by the typographic press.

I have now described the improved mode of producing the visible

design which cannot be imitated either by hand, or by machinery, I shall now state by what means I prevent any impression of these drawings from being transferred on to stone, and afterwards multiplied at will. In order to make this perfectly intelligible, I must describe the inks I use, and the mode of employing them.

Inks, and mode of using them.—The arts of imitation have lately made an immense progress. Clever lithographers transfer on to stone, not only old impressions of type and engravings, but also old manuscripts, and every kind of printing made of delible, or indelible, inks, either oily, resinous, or watery. It cannot, therefore, be considered a wonder, that scientific men look upon it as impossible to create a safety paper which can neither be imitated, nor transferred upon stone.

I have solved the first part of the problem by the improved system of drawings, or designs, and I render it impossible to transfer the impressions by means of the inks I am going now to describe.

I prefer delible inks made with a mixture of oil, gum, or resin, because they are more easily employed in typographical impressions. I make a certain quantity of white ink, composed of balm, capahu, Venetian turpentine, and chalk previously washed and dried. These substances are ground together until they are brought to the consistency of ordinary printing ink. I call this ink No. 1. I take one-half of it and set it aside; in the other half I introduce a sufficient quantity of ordinary ink, reduced to powder by evaporation. This is done in order to give the necessary coloring, that the design to be printed with this ink may be visible to the naked eye, and, at the same time, that the writings made on the prepared paper may be perfectly apparent. This second sort of ink I call ink No. 2.

Instead of dried ink for coloring the ink No. 2, I may use any other coloring substance which is equally delible, or as easily obliterated as common ink powder, in order that any attempts to extract part of the writing formed on the paper may cause the extraction, or obliteration, of the visible design printed on the paper with this delible ink.

An impression is made on both sides of the paper with ink No. 1, and to effect this, old plates, and those which are defective, are suited to this first impression, which, not being visible, need not be made with plates free from defects.

The visible design is then printed with ink No. 2. This latter impression is made with all possible care, and, consequently, with lithographic stones engraved, or prepared, with great precision and care. After these two impressions the paper is dried, pressed, and cut, and shaped for use.

It is not necessary to make these two impressions on two distinct presses; they may very easily be executed by means of a single printing machine with two cylinders, but their details form no part of the present invention, and are foreign to the system of safety paper.

A very good ink for printing the visible design may be made as follows:—

- | | |
|---|--------------------------|
| 1. Chalk well washed, | 20 to 25 parts. |
| 2. Common ink reduced to powder, or by preference, gallate of iron. | 4 |
| 3. Ultra marine blue, | 1 |
| Varnish, | <i>quantum sufficit.</i> |

This varnish, as well as the one above stated, is composed with equal parts of balm of capahu and Venetian turpentine, melted together, and to be used when cold.

Results of the new combinations of Inks, and of the double Impressions.—If a forger attempts to extract a word, or a sentence, or any quantity of writing formed on the safety paper, presently described, he will begin to use chlorine; this agent will destroy the color of the writing, and that of the visible impression, the coloring principle of ink No. 2, being the same as that of ordinary ink. He then will use an acid to remove the oxide of iron, which will still leave traces in the place of each letter, and each lineament of the visible design, which traces cannot be obliterated by chlorine. In this second operation the acid will have destroyed also the chalk contained in ink No. 1, and ink No. 2.

The safety paper, thus treated, will retain at the spot obliterated only the slight marks produced in the substance of the paper by the pressure of the two impressions, and the resinous principles of the two inks employed, for no vestige will remain of the ink with which the writing was formed.

But neither the slight marks left in the paper by the printing of the visible design, nor the vestiges left by the resinous varnish of ink No. 2, will be of any use to the forger in his attempt to reconstruct the design at the place obliterated. To the marks made by the printing of the visible and invisible designs, and the vestiges of the resinous principles left on the paper by the inks No. 1 and No. 2, will be so complicated, and so much worked into one another, that it will be impossible to distinguish any thing.

If, moreover, the conditions of the designs, or the principles upon which they are constructed, are referred to the numerous points of comparison which the same piece of paper will naturally offer, the perfection of the part executed by machinery, the impossibility to imitate by hand, or machinery, the part executed by chance, every one will be convinced that the reconstruction of part of the design will be utterly impossible, and the reproduction of a design by a lithographic transfer will be equally impossible.

In fact, whatever be the process employed to transfer the design on to stone, it will be impossible not to transfer at once the two designs, the visible and invisible one, as both are printed with a resinous ink at the same moment, and the only substance which distinguishes the two printing inks, is a small quantity of dried ink powder, which can have no influence on the transfer, being mixed with a resinous body, which is more readily transferred on to stone than itself.

By counterproofing the design of our safety paper, the forger, instead of finding on the stone the design he expects, will find a surface perfectly black, or presenting a confusion produced by the instantane-

necus transfer of the two designs, which may be identical, but are not placed one on the other in their proper places.

I consider that this system of drawings, consisting of small designs, both delible, the one visible, the other invisible, answers all conditions that are required, and presents to government, trade, and private individuals, a most complete guarantee. It must be understood, that the receipts of inks which we have given are only for the sake of illustration, and that other combinations of appropriate ingredients might produce an analogous result.

The system of preparation of paper for the purposes set forth in the title of the patent being now fully described, I wish it to be understood, that I do not intend to limit myself to the making of designs which will appear in colored lines on a white ground, as I may also produce designs according to this system which will appear in white on a colored ground.

That I may use, for the printing of the visible design, inks of any composition having the qualities above set forth, though I give preference to the kind of ink above stated.

I claim the covering of paper intended for all the purposes indicated in the title of the patent, with two designs composed of elements regular and irregular, and obtained by the means hereinbefore described, one of the designs being printed in visible ink, and the other in invisible ink, both these printings being delible, by employing which means it will be found impossible to re-constitute, or re-construct, the design, of which part has been extracted by chemical agents, and an equal impossibility of transferring the whole design on to stone, in order to multiply it at will, by impressions taken therefrom, and thus a complete guarantee is given to government, to trade, and all private transactions.—*Enrolled December 9th, 1843.*

Lond. Journ. Arts & Sciences.

Specification of a Patent granted to THOMAS DRAYTON, of Brighton, in the county of Sussex, for improvements in Coating Glass with Silver, for looking-glasses, and other uses.—Sealed 25th November, 1843.

A mode of silvering glass, for looking-glasses and other uses, without the employment of quicksilver, constitutes the subject of this patent; it consists in depositing silver, from a solution, upon glass, by de-oxidizing the oxide of silver in solution, in such a manner that the precipitate will adhere to the glass, without the latter having been coated with metallic, or other substances.

A mixture is first made of one ounce of coarsely pulverized nitrate of silver, half an ounce of spirits of hartshorn, and two ounces of water; which, after standing for twenty-four hours, is filtered, (the deposit upon the filter, which is silver, being preserved,) and an addition is made thereto of three ounces of spirit, (by preference, spirit of wine,) at 60° above proof, or naptha; from twenty to thirty drops of oil of cassia are then added; and, after remaining for about six hours

longer, the solution is ready for use. The glass to be silvered with this solution must have a clean and polished surface; it is to be placed in a horizontal position, and a wall of putty, or other suitable material, formed round it, so that the solution may cover the surface of the glass to the depth of from an eighth to a quarter of an inch. After the solution has been poured on the glass, from six to twelve drops of a mixture of oil of cloves and spirit of wine (in the proportion of one part, by measure, of oil of cloves to three of spirit of wine,) are dropped into it, at different places; or the diluted oil of cloves may be mixed with the solution before it is poured upon the glass: the more oil of cloves used, the more rapid will be the deposition of the silver; but the patentee prefers that it should occupy about two hours. When the required deposit has been obtained, the solution is poured off, and as soon as the silver on the glass is perfectly dry, it is varnished with a composition formed by melting together equal quantities of bees'-wax and tallow. The solution, after being poured off, is allowed to stand for three, or four, days in a close vessel; as it still contains silver, and may be again employed after filtration, and the addition of a sufficient quantity of fresh ingredients to supply the place of those which have been used; the patentee states, that, by experiment, he has ascertained that about eighteen grains of nitrate of silver are used for each square foot of glass; but the quantity of spirit varies somewhat, as its evaporation depends upon the temperature of the atmosphere, and the duration of the process.

If the glass be placed in an inclined, or even a vertical position, and the surface covered over, leaving a narrow space for the solution between the surface of the glass and the cover, which fits close, then, by using spirit without water in the mixture, the object will be accomplished. By the addition of a small quantity of oil of carraway, or thyme, the color of the silver may be varied. The oil of cassia, purchased of different manufacturers, varies in quality; therefore, if, on being mixed with the solution, it should become flaky, the solution must be filtered previous to use.

The patentee, in concluding his specification, says, that he does not confine himself to the precise details herein described, provided the peculiar character of the invention be retained, whereby silver is deposited on to glass from a solution of that metal, by deoxidation, in such a manner as to cause the silver to adhere to glass, without any previous coating of the latter.—*Enrolled in the Enrolment Office, May, 1844.*

Ibid.

MECHANICS, PHYSICS, AND CHEMISTRY.

Extracts from the Report of Capt. G. W. HUGHES, of the Topographical Engineers, to the Secretary of War, relative to the working of Copper Ore.

(Continued from page 133.)

Swansea is the greatest manufactory of copper in the world; and

here, nineteen-twentieths of the copper of the kingdom is made. All the ores here reduced, are brought from a distance—some from Valparaiso, some from Cuba, a small quantity from New Orleans, and a large proportion from Cornwall and Devon, and some, but not a great deal, from Holyhead, Anglesea, and from Ireland. It is now 250 years since the first ores were shipped from Cornwall to Wales. The Cuba and South American ores yield about 20 per cent., sometimes, but rarely, 25; the Irish 10 to 12; and the Cornish $7\frac{1}{2}$ to $8\frac{1}{2}$. I could learn but little about the ores from the United States, except that they were pretty good. Ores yielding 20 per cent. of copper are worth, at the furnaces, *when prepared for smelting*, from £18 to £20 per ton, or between \$90 and \$100 per ton of 21 cwt.* The best metal is worth from £100 to £120 per ton, and the profits are said to be large.

The following table (extracted from the official report of Mr. De la Beche, director of the Ordnance geological survey,) of the foreign and British ores, sold to the proprietors of the Swansea works, by ticket, in the manner practiced in Cornwall, may be useful in showing the amount of foreign copper ore imported into South Wales, during the year ending 30th June, 1838, as also the produce of some of the copper mines in Ireland and Wales, for the same time:—

	21 cwt.	£	s.	d.	£	s.	d.
Allikies, . . .	4,575	43,436	0	6	9	9	10
Ballymurtagh, . . .	6,711	21,840	16	0	3	5	1
Ballygahan, . . .	634	2,322	10	6	3	13	3
Chili ores, . . .	5,619	115,915	1	6	20	12	7
Cobre mines, . . .	5,644	114,406	15	6	20	5	4
Copiapo, . . .	1,047	19,475	9	0	13	13	4
Cuba, . . .	1,133	20,604	11	0	18	3	8
Cronbane, . . .	2,056	7,499	19	0	3	12	11
Connore, . . .	350	1,552	9	6	4	8	8
Crom, . . .	23	194	7	0	8	9	0
Drwsycoed, . . .	400	2,332	17	0	5	16	7
Knockmahon, . . .	6,345	53,561	10	0	8	8	9
Llandidno, . . .	811	6,909	17	6	8	10	4
Llanbenis, . . .	494	2,083	6	6	4	4	4
Llandegai, . . .	66	469	2	0	7	2	1
Laxey, . . .	137	513	9	0	3	15	0
Mexican, . . .	90	797	13	0	8	17	3
Norway ores, . . .	1,591	18,303	7	6	11	10	0
Penralt, . . .	74	494	18	6	6	13	9
Symnia dylluan, . . .	186	1,425	0	6	7	13	2
Sygun, . . .	183	728	19	6	3	19	8
Sundries, . . .	362	1,780	1	0	4	18	4
Tygrony, . . .	2,034	9,354	18	6	4	12	0
Union, . . .	446	1,460	9	0	3	5	5
Valparaiso, . . .	1,920	33,859	14	0	17	12	8

Average standard £97 17s. Average produce 14½. Average price per cwt., £11 4s. 6d. Fine copper, 5,906 tons 9 cwt. 2 qrs. 25 lbs. Amount of money, £481,323 3s. Copper ore, 42,931.21 cwt. The amount of copper ore thus sold in Cornwall and Swansea, for the year ending, as above, would amount to 188,619 tons, (of 21 cwt.

* This, of course, varies with the standard value of fine copper.

each,) estimated to contain 17,433 tons of fine copper, and sold for £1,339,102 14s. From another source, I have ascertained that the amount of copper ore smelted at Swansea, from 30th June, 1839, to 30th June, 1840, was 203,545 tons of 21 cwt. Produce in fine copper, 19,511 tons 1 cwt. 3 qrs. 24 lbs., worth £1,466,770 7s. 6d.

Copper ore imported into the United Kingdoms, for the year ending 5th January, 1840, 28,757 tons. Average value of Cornish ores, in the year ending 30th June, 1840, £5 7s. 6d.

Average value of Cuba ores, for the year ending June 30th, 1840, £14 12s. 4d.

Average value of Cobre ores, for the year ending June 30th, 1840, £16 10s. 3s.

Average value of Chili ores, for the year ending June 30th, 1840, £19 4s. 0d.

Average value of Valparaiso ores, for the year ending June 30th, 1840, £19 7s. 3d.

The foreign copper ores are merely introduced for the purpose of smelting, and the purchasers of such ores are bound to export as much copper as is estimated, from assays made previous to sale, to be contained in them; hence the quantity necessary to be exported depends on the accuracy of such assays.

The amount of metal procured from foreign ores is sometimes nearly, or quite, one half of the entire reduction; but, for a few years past, it has greatly diminished, owing to some failure, or difficulty, in working the mines, or, perhaps, to the disturbed political condition of the South American States. In 1837, it was nearly one-third of the whole reduction. Copper pyrites, or the *bi-sulphuret* of copper, is the chief ore of that metal which occurs in Devon and Cornwall, other copper ores being found in comparatively small quantities. The next in importance is the *sulphuret*, or *gray*, ore of the miners. The *black ore*, or oxide of copper, is sometimes found in sufficient quantities to be worked to advantage. The carbonates are rich, but are seldom used except when mixed with the other ores, owing to the tendency of the metal to escape with the liberated volatile matters they contain. The escape of carbonic acid gas carries with it much of the metallic base, in a state of sublimation.

It is thought that nearly all the metal from the ore is extracted, not losing more than a half per cent. beyond the assay; but it is not clear that they obtain all that chemical analysis would show. The assay is usually by the *dry mode*, and analogous to the process of reduction on a large scale.

Tin, Tin Ores, and their Reduction to a Metallic State.

Tin is a metal of a yellowish white color, considerably harder than lead, but less so than gold, very malleable, but not tenacious. Hence wire cannot be made of it; but under the hammer it may be extended into very thin leaves, called *tin foil*, less than the one-thousandth of an inch thick. It exhales by heat a peculiar sweetish odor, and may be recognized by a crackling noise when bent. Its specific gravity, when pure, (in which state it can seldom be found, as it is

not often obtained pure from the ores, and when so, is generally adulterated afterwards with lead,) is 7.290.* It melts at 442° of Fahrenheit.

This metal has been known from a remote antiquity, and it seems to be well ascertained that the Phœnicians traded to Cornwall for tin long before the conquest of Britain by the Romans.

It is still a matter of much doubt whether *native tin* has ever been discovered. Magellan says he has, *undoubtedly*, found it in three different states: 1st, malleable in a granular and foliaceous form, imbedded in arsenic; 2nd, in crystalline lamina, or flat crystals; 3rd, in a massy form, more than an inch thick in some places, and enclosed in a stone resembling quartz, which was believed to be a hard crust of crystalized arsenic.†

It is generally believed, however, that this metal exists naturally in but two forms; that is, as a peroxide, or tin stone, and as a sulphuret, or tin pyrites. The latter is rather a rare mineral, the former being the only combination of tin worked as an ore.

Tin ore is seldom found in workable quantities. Its principal localities in Europe, are Cornwall, Bohemia, and Saxony; and in Asia, Malacca and Banca. When found *in situ*, it is always in the most ancient rocks. It does, however, often occur in alluvial deposits, being, no doubt, the detritus of broken down lodes.

The mode in which the tin ore occurs in lodes associated with ores of copper, and of other metals, and in *stockwerkes*, or strings, running along the divisional planes of certain granites where it is found with schörl, has been already described. It often forms "bunches" in the lodes, similar to the patches of copper ore before mentioned. It is sometimes extracted from the gossan accompanying copper lodes, and often occurs in the copper lodes.

The oxide of tin has but little of a metallic aspect, and some specimens of it none whatever. In some cases it is so minutely disseminated, that it can be detected only by the experienced eye of the miner, or by its great specific gravity, which ranges between 6.3 and 7.00. Its most usual color is a *dark liver brown*; it occasionally slightly resembles blende, and presents a resinous appearance. It has the hardness of felspar, and gives fire with steel. Its structure is imperfectly foliated.‡ It is found amorphous, in rolled masses, in grains, and often in crystals, whose primitive form appears to be an octahe-

* Few chemists have agreed as to the specific gravity of tin, owing to the difficulty of obtaining it pure. Dr. Cooper took the *best grain tin* he could procure, melted it, and allowed it to cool very slowly. He then ascertained its specific gravity to be 7.170

Ure and Cleaveland stated it to be, as in the text, . . . 7.290

Cotes, Ferguson, and Emerson, at . . . 7.320

Bœrheave's Chemistry, . . . 7.321

Musschenbrœck and Wallerins, at . . . 7.471

Martin, . . . 7.550

The specific gravity of pure lead is about . . . 11.380

† Emporium of Arts and Sciences, vol. iii, (new series.) Cortes states, in his despatches to the Emperor Charles V., that he found *metallic tin* amongst the Mexicans. As it is not probable that they were acquainted with the art of reducing metallic ores, may not this have been *native tin*?

‡ Cleaveland's Mineralogy.

dron, or double four-sided pyramid, with square bases. Its general secondary form is a rectangular four-sided prism, whose edges are liable to truncation, or bevelment. Before the blow-pipe it decrepitates, and its powder, strongly heated on charcoal, may be reduced to metallic tin; it is often contaminated with copper, arsenic, and iron. A specimen from Cornwall yielded Klaproth tin 77.50; oxygen 21.5; silic 0.75; iron 0.25. A specimen from Schlackenwold gave him, tin 75.0; oxygen 24.00; iron 0.50. Lampardins obtained from a Bohemian sample, tin 68; oxygen 16; silic 7.00; iron 9.00. Dr. Thompson gives the following as the constituents of a crystalline reddish brown ore from Cornwall, the specific gravity of which was 6.945; peroxide of tin 96.265; silic 0.750; peroxide of iron and sesqui oxide of manganese 3.395.

Sulphuret of tin has been rarely found out of Cornwall, so far as I am informed. Its color is steel gray, more, or less, mixed with yellow. It is never crystalized. Its specific gravity is between 4.35 and 4.78. According to Klaproth, it contains, sulphur 25, tin 34, copper 36, 2 of iron, and 3 of stony matter. A specimen analyzed by Professor Johnstone, of Durham, gave, tin 31.618, copper 23.549, zinc 10.113, iron 4.79, sulphur 29.929. It was first discovered by Raspe, in Wheal Rock, St. Agnes, Cornwall, who proposed to call it *bell-metal ore*. It is probably a mixture of sulphuret of tin and copper pyrites, the zinc and iron being accidentally present.

The first tin worked in Cornwall, was the *stream tin*, as the ore found in alluvion is called. The lodes, or veins, were discovered by following up the course of the stream tin. Much of this kind of ore is crystalized, often in hemitrope crystals, and sometimes is pseudo-morphous crystals of felspar. It is, no doubt, brought from the lodes, but seems to have undergone some purifying action, as it is free from many of the deleterious substances that are found mixed with the vein ore; from it is obtained the *grain tin*, which is of the very best quality. It would appear, from the pseudo-morphous crystals, that the stream tin had been, at one time, in a state of solution. The working of the alluvion tin is extremely simple, the ore being separated from the earthy matter, with which it is surrounded, by the action of running water. The stream tin from Pensagillis, is remarkable on account of the native gold occasionally found in it; sometimes, although rarely, in pieces of the value of two, or three, pounds sterling. The most important deposits of *alluvial tin*, occur in the vicinity of St. Just and St. Austill. I have seen miners working the stream tin extensively on the sea-coast, between Marazion and Penzance.

The *mine tin* is seldom pure, and requires much care in the mechanical dressing of it, to separate it from the foreign substances with which it is combined.

The *block tin*, or the most common tin of commerce, is procured from this source. In consequence of the great specific gravity of this ore, water is extremely useful in its preparatory dressing. After having been carefully washed, by agitation in running water, it is sorted by hand into four lots: 1st, stones rich in tin; 2nd, stones con-

taining tin and copper; 3rd, copper ore; 4th, steril fragments, composed of vein stone, with iron and arsenical pyrites.

The tin ore is then ground, generally by water-wheels, in cast-iron hoppers, (having been previously broken by hammers into convenient fragments,) and is next stamped to the size of fine sand, with water running over it during the operation; it is then removed to long shallow vats, where it is *buddled*, by passing a current of water over the ore arranged on an inclined plane, similar to the mode of treating copper ores already described. The upper, or heavier, portion is the best, and is separated from the tail of the trough, where the finer and lighter portions of ore are deposited, mixed with sand. This portion is re-submitted to the same operation, by being carried to another trough, or buddle, where the water is only gently agitated over it by means of hoes. The head of the buddle, in this case, is taken to tables, so placed, that water may be passed over them, and the ore being constantly stirred, the current carries off the light, or earthy, matter, leaving the peroxide of tin in a more, or less, pure state. After this washing process has been completed, the tables are suddenly turned over, and the contents emptied into a receptacle partly filled with water.

After the ore has been sufficiently washed, to leave it nearly free from earthy matter, it is carried to the calcining furnaces, for the purpose of dissipating the volatile substances it contains, and of oxidizing the iron and copper, in order that they may, by being thus rendered specifically lighter, be removed by a rewashing. When those metals exist in considerable quantities, it is next to impossible to get entirely clear of them, as will appear in the sequel, although their presence is certain to deteriorate the character of the tin; which, however, does not injure the copper ores, but, on the contrary, sometimes adds to their value.* When the ores are refractory, they are restamped, re washed, reheated, and again washed, before they are fit for assaying. When the tin ore is unmixed with much iron, or copper, it is not calcined, but is carefully re washed in the refining house before smelting. The preparation of the tin ore becomes much more difficult when it contains *wolfram*, (tungstate of iron and manganese,) the specific gravity of which is rather greater than the pure ore.

Tin ores, like copper ores, are, at present, generally sold by the "*ticketing system*." Formerly they were reduced on shares.

The Cornish mode of assaying tin ores consists generally in taking two ounces of black tin, or tin ore, and adding to them a flux composed of culm, about one-third the weight of the ore, and of borax 4 dwts. If the ore contain much iron, more culm is added. This being exposed to a strong heat, a button of tin is obtained, the value of which is estimated by its properties under the hammer. The scrapings of the crucible are usually washed, to search for any tin which may be in them.†

Another method, recommended by Dr. Cooper, and, perhaps, a better one, is the following:—

* Sometimes called "bell-metal" ore.

† De la Beche.

Pound the ore ; separate it from the stony matters that accompany it ; take a small piece of ore, and roast it on charcoal with the blow-pipe ; if any sulphurous, or arsenical, fumes should arise on this trial, the pounded ore must be well roasted, previous to fusion, with a little charcoal ; if no such vapors appear, the roasting may be dispensed with. Take 400 grains of the ore ; smear the sides of a crucible with charcoal, and put a small quantity of charcoal dust in the bottom ; mix up the pulverized ore with pitch and saw-dust ; lute a cover on the crucible, then urge it with a fire quickly raised, during fifteen minutes, in an air furnace, or blacksmith's forge, at the end of which time the metallic tin will be found at the bottom of the crucible.

For more exact, satisfactory, and scientific assays, see Bergman, Klaproth, and especially Berthier, (*Traité des Essais par la Voie Sèche*, tome ii.)

All, or the greater part, of the Cornish tin ores are reduced in Cornwall.* The principal works for this purpose are at St. Austill, Penzance, Truro, and Redruth. The furnaces I visited belonged to the Truro Company.

The ore (prepared as already described,) is mixed with charcoal, and placed in a reverberatory furnace, and the flame of burning *culm* (fine anthracite) is passed through it for six hours, when the melted metal is drawn off at one aperture, and the cinders at another ; a small quantity of lime is sometimes added, for a flux. The melted tin is carried in cuvettes, and poured into iron moulds, from whence it is taken, when cold, to the refining furnace, and again melted ; but not in contact with the flame. It is, in fact, a liquation, the tin running out of the pigs into a receptacle below the hearth of the furnace, on which it leaves a mixed residuum of iron, copper, &c. The liquated metal is then drawn off into a large caldron, in which have been previously arranged several pieces of carbonized wood, saturated with water, to produce ebullition. This process separates the dross, which, floating on the surface, is skimmed off. The boiling, or effervescence, is so strong that it requires a weight of 300 pounds to retain the standard, to which the wood is attached, in the caldron. When the tin ore contains much iron, a piece of sheet-tin (tinned iron) is put into the refining furnace, to assist the separation of the metals.

The refined tin is dipped out of the caldron by ladles, and is run into shallow granite troughs, which form it, by cooling, into truncated pyramids, weighing nearly 400 pounds. The refining operations require from 5 to 6 hours' time ; an hour to fill the basin, three hours to boil the tin with the green wood, and from one to two hours for the subsidence. The first dippings are the purest ; and the last are so much alloyed with foreign matter, that they must be again refined.

The refined tin is generally separated into three divisions, according to its quality ; 1st, *grain tin* ; 2nd, *refined tin* ; 3rd, *common tin*. The first is very nearly pure tin, and is generally obtained from the *stockwercke*, or *stream, tin ores*. The second contains copper and iron ; and the third a considerable proportion of both, and some-

* The exportation of tin ores from Devon and Cornwall is prohibited by law.

times lead, purposely added. The presence of iron is less objectionable than copper. Each of the above divisions is again divided into first and second qualities. The first class, or *grain tin*, is employed for the more important alloys and amalgams; the second, for tinning iron, and for dyeing; and the third, for common solders.

The stream tin ores, and sometimes the better class of mine ores, when it is desirable to obtain a metal of unusual purity, are reduced in *blast furnaces*, or blowing-houses, as they are called, with charcoal. And this, indeed, was the ancient method of smelting all ores of tin.

Doctor Ure says:—"On making a comparative estimate of the expense by the *blowing-house* process, and by the *reverberatory furnace*, it has been found that the former yields about sixty-six per cent. of tin in smelting the stream, or alluvial, ore, whose absolute contents are from seventy-five to seventy-eight parts in the hundred. One ton of tin consumes a ton and six-tenths of charcoal, and suffers a loss of fifteen per cent. In working with the reverberatory furnace, it is calculated that ore, whose mean contents, by an exact analysis, are seventy per cent., yields sixty-five per cent. on the great scale. The average value of the tin ore, as sold to the smelter, is £50 per ton; but it fluctuates, of course, with the market prices. One ton of tin obtained from the reverberatory furnace costs—

One ton and a half of ore,	£75	00s.	0d.
One ton and three-quarters of coals,		17	6
Wages of labor, interest on capital, &c.,	3	00	0
	£78	17	6

"On comparing these results with the former, we perceive that in a *blowing-house* the loss of tin is fifteen per cent., whereas it is only five per cent. in the reverberatory furnace. The expense of fuel is likewise much less, relatively, in the latter process; for only one ton and three-quarters of coals are consumed for one ton of tin; while a ton and six-tenths of wood charcoal are burnt to obtain the same quantity of tin in a *blowing-house*; and it is admitted that one ton of wood charcoal is equal to two tons of coals in calorific effect. Hence, every thing conspires to turn the balance in favor of the reverberatory plan. The operation is also in this way simpler, and may be carried on by itself. The scoriæ, besides, from the reverberatory hearth, contain less tin than those derived from the same ores treated with charcoal by the blast, as is done at Altenberg. It must be remembered, however, that the grain tin obtained by the charcoal process is reckoned to be finer, and brings a better price—a superiority partly due to the purity of the ore reduced, and partly to the purity of the fuel."

For more than six centuries, the tin, after being smelted, was carried to certain towns, called "Stannary towns," to be assayed, for the purpose of ascertaining the quality of the metal. It was then stamped with the Duchy seal, the dues paid to the Earls, or Dukes, of Cornwall, and the blocks permitted to be sold. The average yearly revenue to the Crown, from 1820 to 1838, was, from this source, between

£11,000 and £12,000. By an act of Parliament of August 16, 1838, the duties paid on coinage were abolished, and a compensation, in lieu of them, paid to the Duchy; and at the same time the duties on the importation of foreign tin were reduced, and fixed at fifteen shillings per hundred weight for tin, and ten shillings per hundred weight of tin ore.*

Before the passage of the act of 1838, each block of tin was coined, according to Borlase, in the following manner:—"The officers appointed by the Duke of Cornwall assay it, by taking off a piece of one of the *under* corners of the block, partly by cutting, and partly by breaking; and, if properly purified, they stamp the face of the block with the Duchy seal, which stamp is a permission for the owner to sell, and, at the same time, an assurance that the tin so marked has been properly examined, and found merchantable." This rude mode of assay was founded on the supposition, that if the tin had been adulterated with lead, the foreign matter would, owing to its greater specific gravity, sink to the bottom. In foreign countries, the English stamp was often counterfeited; and, it has been said, "in Holland every tin founder has English stamps, and, whatever his tin be, the inscription '*block tin*' makes it pass for English." It is asserted that much of the Dutch tin contains nearly one-tenth of its weight of lead.

From midsummer of 1837, to midsummer of 1838, there had been coined, in Devon and Cornwall, 5,130 tons of tin, of which 1,545 was *grain tin*, and the remainder common tin. The quantity of tin imported into Great Britain, in the year ending January 5, 1838, was 1,451 tons, and the quantity exported, during the same interval, was 1,465 tons—leaving the English production of that year for British consumption.

Mr. De la Beche, in a note to his elaborate and valuable report on the Ordnance Geological Survey of Great Britain, submits the following estimate of the annual produce of British mines, which may prove of some interest to the general reader:—

Iron, at	£8,000,000
Copper, at	1,200,000
Lead, at	920,000
Tin, at	390,000
Manganese, at	50,000
Silver, at	30,000
Zinc, at	7,000
	10,597,000

If to the above sum, for metallic produce, we add £9,000,000, as the value of coal raised at the pit mouth, and about £400,000 for that of salt and other minor substances, we should have £20,000,000 as the annual value of the mining produce of Great Britain and Ireland.

To be Continued.

* De la Beche, Ordnance Geological Survey.

Improved Blast-Furnace Hearth.

A correspondent of the *Monmouthshire Merlin* writes:—"I forward you a brief sketch of a blast-furnace hearth, which I have lately seen at the works of the British Iron Company, near Pontypool. It exhibits some variation from the usual mode of construction, and appears to me to be worthy a notice in your columns. The hearth and boshes of blast furnaces are generally formed of a coarse grit, or conglomerate, popularly known as the 'plum pudding stone.' These are procured in blocks of enormous size, and, when fixed in their place, jointed with fire clay, in order to resist the action of the intense heat to which they are exposed. These stones having frequently to be brought from a considerable distance, and the dressing also requiring much labor, the expense attending this mode of construction is, consequently, very great; and, of late, some hearths have been built of fire bricks. This plan is, of course, much more economical as regards the first construction, but is not so durable as the older and more popular method. Now, in the case to which I allude, as an improvement on both of the above-mentioned modes, the durability of the former seems to be attained, while the expense of erection is even less than in the latter; and this is effected by the use of common stones, and of ordinary size. The stone employed for the purpose was mill-stone grit, which was selected with as little silex as possible; and the hearth was built in the following manner—the bottom was first formed with burnt brick, 2 ft. 1 in. long, 9 in. wide, and $4\frac{1}{2}$ in. thick, laid on their ends and cemented with fire-clay. Over this pavement a bed of sand was placed, in which the first course of stones, forming the face of the hearth, was laid—these stones being rough-polled, and the joints well rammed with sand; and in this manner the mason work was continued to the top of the hearth. The stones were used without any attention to their size, and perfectly rough, the hatchet end of the hammer, not even being used to dress them, this plan being pursued, I should suppose, with the impression that the cinder on which the furnace was 'blown in,' would adhere better to the sides of the hearth, in consequence of such roughness. The outer casing of the hearth was formed of fire-bricks, laid in fire-clay. The dimensions of the hearth are as follows:—At the bottom, internally, 4 ft. square, and at the top, 5 ft. 8 in., the batter in the sides being $1\frac{1}{2}$ inch to a foot. and the extreme size of the hearth 12 ft. square. The furnace was worked with blast-furnace cinder for about a week, and has answered extremely well, although it was the impression at the time, even of a very intelligent man engaged in its erection, that the plan would not be attended with success. The opinion, indeed, was, that no cement having been used in the work, the stones being simply bedded in sand, they could not possibly adhere together, or, to use the words of the person above alluded to, would all 'swim about,' in the fiery metal. The cinder employed in the first instance has, however, undoubtedly had the effect of forming 'a glaze,' over the hearth, and cementing the masonry into one firm and compact mass. Permit me to make one more observation, in conclusion. I have frequently heard

it remarked that blast-furnaces are sometimes a considerable period before they arrive at a good workable condition—in short, supposing the furnace be not constructed upon correct principles, it will not work to a good yield, until it has, by its own efforts, so modified the form of the different parts, as to adapt them to the peculiar circumstances of the case, by adding in one place, or removing an obstacle in another. Taking a hint, then, from these facts, would it not be advisable—at all times, whenever possible—to make an examination of a furnace which has been found to answer well, at any particular work, and to adhere strictly to the form which it has assumed in the progress of working, as that which is best adapted to the nature of the materials employed?”

Lond. Min. Journ.

On a curious Change in the Molecular Structure of Silver. By
ROBERT WARINGTON, Esq.

The subject of the present brief communication was put into my hands by my friend, Mr. Porrett, after our last meeting, as bearing on the subject of the memoir which I had the honor of reading before the Society in January, 1842; a subject I am still prosecuting, as my time will permit, and the results of which I hope to lay before the Society at an early date.

It appears, from information furnished me by Mr. Porrett, to have been part of a silver funeral vase, and was discovered by some laborers, about four months since, at the depth of seven feet below the surface of the ground, while digging for brick-earth, between Bow and Stratford. Its height was about ten inches, and its greatest diameter about eight inches; it weighed 40 ounces, and had a smaller vase, about the size of a human heart, in its interior. When brought to Mr. Edwards, a watchmaker resident in Shoreditch, by whom it was purchased, it was without a cover, and the contents had been thrown away, with the exception of some black ashes, which were not preserved. Its thickness was about from 0.015 to 0.017 of an inch, its surface presented a dull tarnished aspect, and was stained in patches with red oxide of iron. It was extremely rotten and brittle, breaking by the application of the slightest force; the surfaces of fracture were uneven and of a bright white metallic lustre. When examined under the microscope by a power magnifying 100 diameters, it presented a highly crystalline structure, the facets of the crystals being exceedingly bright and approaching the cubic form, but none of them could be observed perfectly developed; they were more analogous to the characters of grain tin in its broken state as met with in commerce. It appeared, also, as though there had been a recrystallization of the metal, as the particles looked as if they had been drawn from the central part to the sides of the thin plate, leaving cavities or interstices of considerable extent and depth; the exterior surface was also coated with a film of about 0.0005 of an inch thick, having a grayish-olive colour, and totally different in its structure from the other parts, being

striated across its breadth. The specific gravity of the metal in this state was found to be 9.937, great care having been taken to remove the air from the internal cavities by mean of the air-pump.

The metal was next heated to redness in a crucible, and the heat sustained for about ten minutes, after which its characters were found to be totally altered; it had lost its extreme brittleness, requiring to be bent several times before a fracture could be effected, and then, by the aid of the microscope, exhibited a close, small grained tough aspect of a dull white colour, and without the previous cavernous appearances; the superficial film seemed also in places to have partially separated from the substance of the thin plate of metal during the bending. The specific gravity was again taken, adopting the previous precautions, and was found to be 9.95, making an increase of 0.013 on the gravity taken before the application of a red heat.

It was next submitted to analysis; 8.5 grains were digested in dilute nitric acid, and the soluble parts (A) decanted, and the residue well washed. This residue was in small thin grayish-white flakes, and by exposure to the light became rapidly of a purple tint, indicating the presence of chloride of silver; fearing that this might have arisen from some accidental impurity in the materials employed, both the nitric acid and distilled water were carefully tested and proved to be perfectly pure; it was therefore digested in a weak solution of ammonia, which dissolved the whole, with the exception of a small quantity of brown powder, which was found to consist of 0.06 gr. of peroxide of iron and a trace of gold. The ammoniacal solution was precipitated by nitric acid, and gave 0.52 gr. of chloride of silver.—The solution (A) was next precipitated by solution of chloride of sodium, and gave 10.25 grains of chloride of silver, equivalent to 7.66 grains of silver; solution of caustic potash and boiling threw down the oxide of copper, and yielded 0.30 gr. oxide of copper=0.24 gr. of copper. Thus we have—

Silver	7.66 grains.
Chloride of Silver . .	0.52 ...
Copper	0.24 ...
Oxide of iron . . .	0.06 ...
Gold	a trace
	S.48
Loss	0.02
	8.50

It becomes a curious question as to the origin of this chloride of silver, which was evidently the superficial grayish film observed under the microscope, and which partially separated in the act of bending the metal after heating. That it must have been produced by the continued action of chlorides, perhaps aided by sulphates present in the brick clay from which the vase was excavated, there can be little doubt, and the peroxide of iron also existing in the clay may have assisted this action.

The passage of the metal to the brittle state in this and in all other cases will, I think, be found attributable to some electrical action arising.

ing from sudden cooling, vibration or concussion, chemical action, &c., to which the metallic body or alloy may have been exposed.

Proc. Chem. Soc.

FRANKLIN INSTITUTE.

Report on the Explosion of the Gun on board the Steam Frigate "Princeton."

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for investigation the cause of the Explosion of the Gun on board the steam frigate Princeton,

REPORT:—

That they commenced their labors on the 5th of April last, at a preliminary meeting, on board the Princeton, for the purpose of inspecting the gun in place, and for arranging the order, &c., of the investigation. The deliberations of the committee, at this meeting, led them to the conclusion, that a complete and satisfactory examination of the causes of the explosion, would render it necessary to institute a judicial procedure, in reference to the method of proving and firing the gun, requiring a power not possessed by a committee of the Franklin Institute. This difficulty being presented to the applicant, the committee were, subsequently, requested to "investigate the material and workmanship of the gun;" and they have, consequently, limited their inquiry to this part of their original instructions.

In the first place, the actuary of the Institute was directed to address a series of questions, furnished by the committee, to Messrs, Ward & Co., the manufacturers of the gun; and one of the committee was requested to make such drawings and measurements as would facilitate the investigation. To another member of the committee was entrusted the duty of causing to be cut from the gun a number of pieces of iron, in the form of bars, by means of a planing machine, or other instrument, so as not to change the texture of the metal, and which might serve as specimens for testing the quality of the material. The largest of these bars was afterwards given in charge to a member of the committee visiting Boston, to be tested by an apparatus for breaking iron in that city, and the other bars were placed in the hands of the other members of the committee, to be experimented on in Philadelphia, by the breaking apparatus belonging to the Franklin Institute. These duties, assigned to the several members, have been faithfully executed, so far as time and opportunity would permit.

I.—*Inspection of the Gun.*

The committee found the gun broken across, within the trunnion bands; the front part remaining entire, and still, at the time of inspection, in its original connexion with the carriage—the breech part had evidently split into three large, unequal, and irregular pieces. Two of these, according to testimony, passed overboard, and have not since been found; the other piece fell on the deck, at the distance of about thirty feet from the carriage. The appearance of the cross fracture

at the trunnion bands, is shown in Fig. III, and in this, the relative size of the faces of the fractures left by the three segments blown off, are exhibited. The only remaining fragment of the breech part of the gun, that which fell on the deck, is shown in Fig. I. It is five feet long, and, at the larger end, embraces a little more than half of the entire circumference of the gun; (see Fig. II;) at the middle of the fragment, the transverse section forms a sector of a circle of about 120 degrees; and at the end next the trunnions, where it separated from the fore part of the gun, it forms a sector of about 90 degrees, as is shown at *a*, Fig. III. It is evident to the committee as before stated, that the breech part split into three large fragments; but it would appear, from the testimony of persons on board at the time of the explosion, that, besides these, a number of small pieces were thrown off in different directions, some of which are said to have passed through the sails: of the number and size of these pieces, the committee have no means of judging.

II.—*Mode of Construction, and History of the Material of the Gun.*

In reference to the mode of constructing the gun, and the history of the material of which it was formed, Messrs. Ward & Co., readily furnished direct answers to all the questions proposed to them, and expressed a laudable desire to give the committee any information in their possession, which might tend to throw light on the investigation.

The following are the questions proposed to Messrs. Ward & Co.:

1. Of what description, and from what locality, was the ore from which the iron was made?
2. By whom, and where, was the iron made? Was the cold, or hot, blast used? Was, or was not, the iron puddled? Was it manufactured by hammering, by rolling, or by both processes?
3. In what state, and of what size, were the pieces of iron of which the gun was composed? Was the iron introduced into the work in the state of blooms, or bars? If in bars, of what dimensions were they? And were the fags trimmed?
4. Was any substance used to assist in welding? What was the aggregate time during which the gun was kept heated? And what was the average interval during which the surface was exposed in a heated state between the weldings?
5. Please to describe the mode of manufacture of the gun, and the position of the bars severally, as they were welded together.
6. What was the diameter of the shaft made by the first faggot; and the whole diameter of the shaft made by longitudinal bars?
7. Please forward, if possible, specimens of the iron of the gun.

And, in conclusion, the committee will feel much indebted to you for any information which may appear to you to be of interest, in reference to the investigation, and especially in reference to the change of structure, which is supposed to take place in iron under long heating.

To these questions the following answers were given, in the order in which they were proposed:—

1. The ore, from which the bars used in the gun, were chiefly made, was from beds in the vicinity of Clintonville, in this State, (New

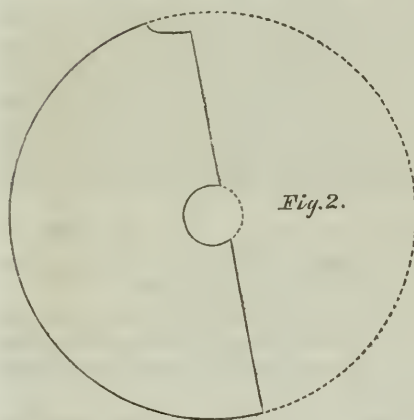
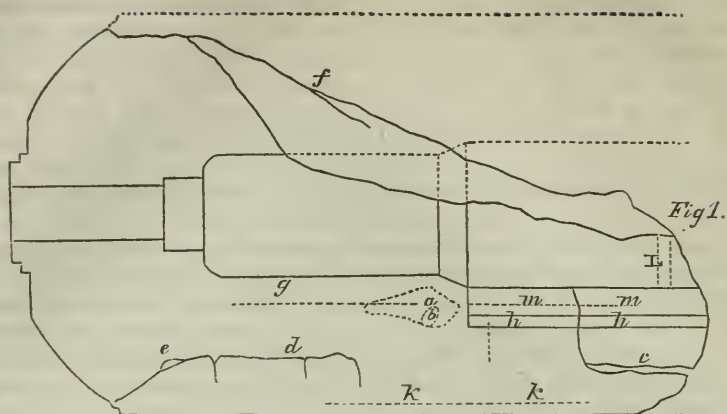
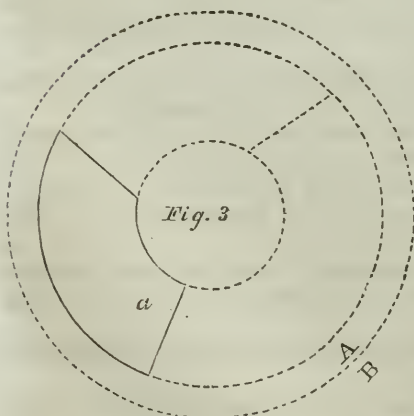


Fig. I, view of the fractured surface, and of the interior of the bore of the large fragment.

Fig. II, section of the fragment across the large end next the breech.

Fig. III, section across the small end of the fragment shown in Fig. I, near the trunnions.



A, outline of gun under the trunnion bands.

B, outline of the gun at the breech.

Scale, three-fourths of an inch to the foot.

York,) and known as the Arnold and Palmer ore, and we suppose it was used in about equal proportions.

2. The principal part of the iron was made at forges on the Ausable river, in Clinton county, by two, or three, different individuals, and we believe that the hot blast is used by them all; a few hundred weight of the iron used on the small end of the gun, in lengthening it out, was puddled by ourselves, on the old plan, with bituminous coal, and without artificial blast, and the whole throughout was manufactured by hammering alone.

3. Much the largest part of the iron used, was in the form of bars, four inches square, and in length of about eight and a half feet. No blooms were used. A part of the bars, we should think about one-half, were trimmed at the end, the others not; though the bars in the faggot, with which we commenced, reached to the extreme end of the breech, and was then drawn down from twenty inches diameter, to about half that size, and then cut off, by which means the fag ends were effectually got rid off, and, at the same time, the fibre of the iron drawn round the end of the breech to give it strength.

4. No substance whatever was used to assist in welding. Forty-five and a quarter "turns," or days' work, were expended on the gun from the time of commencement to its completion, during which time it was, of course, kept more, or less, heated, and the average time in getting a welding heat, when at the full size, was, on the breech, about four hours, and, on the small end, two and a half to three hours.

5 and 6. The work was commenced with thirty bars, of dimensions the same as before described, laid up in the usual manner of a faggot. These were heated and welded together, and, when so done, rounded up, forming a shaft from twenty to twenty-one inches in diameter. Iron was then laid on to enlarge the size, being, for the most part, prepared in the form of segments, partly from scraps of our own working, and partly from bars, and made of different thicknesses, to suit the position for which they were intended on the gun. The weight of them must have varied from about two hundred to eight hundred pounds; the heaviest ones being put on the breech on which were laid two tiers, or strata, the one being first welded, and then the other upon the top of it. They were of such length usually that three of the segments reached round the body of the gun.

7. We have but two small pieces of the gun, which we had chiseled off from one of the fragments, and which we wish to preserve. We would send them, however, were it not easy for you to get supplied in the same way.

In conclusion, we beg to remark, the iron was such as we had on hand when the thing was ordered, and was not made with any special reference to a gun. It was what we agreed to use in it, and was recommended by us as iron of a good and suitable quality; and of this fact we have evidence the most ample. We had no time for preparation of any sort; the order for the gun being given on, or about, the 4th of July, and the work commenced in two, or three, days afterwards. The iron appears, to some extent, crystalized, though we have seen instances when good iron broken by a sudden

and violent force, appear much more so. With regard to its density, no doubt, this will vary slightly in different parts of the gun, some parts having been expanded, by long heating, after it had become of such a size, that no hammers, at present known, could affect it much, though the hammer, under which this piece was made, weighs fifteen thousand pounds. The weight of the gun, before being bored, was twenty-seven thousand three hundred and ninety pounds. Iron when long heated, and not much drawn, we apprehend, in all cases, loses something of its fibrous properties, and assumes a more crystalline appearance.

Your committee, we trust, are aware that the gun stood a charge of $49\frac{5}{16}$ lbs. of powder, with a ball, in the coldest weather of the past winter, and this under the disadvantage of being secured firmly down, and not in a carriage where it could recoil. It occurs to us to mention, that the bands which we made for the other gun, and which held it together for more than a year past, were made from the same kind of iron as that of the exploded gun."

Although the information contained in the answers of Messrs. Ward & Co., rests on voluntary testimony, yet the committee place the fullest confidence in its accuracy, so far as it is derived from the personal observations of these gentlemen. The answers, however, do not state distinctly the process of manufacturing the iron, of which the principal part of the gun was made; and, on this point, the committee have since received information, also entitled to credit, that at the forges mentioned by Messrs. Ward & Co., the iron is formed directly from the ore, and without piling. Although iron thus prepared is called, by some, a good "merchantable article, the committee consider it of an inferior quality for purposes where great strength is required.

III.—*Examinations relative to the homogeneity of the Metal, the Welding, &c.*

In order to a preliminary examination of the quality of the material, pieces from different parts of the large fragment, were broken off, and the fresh fracture, exhibited by these carefully inspected. The surfaces of these pieces were found to vary from a fine granular, to a coarse crystalline texture, and in one specimen, the face of a crystal was exhibited three-fourths of an inch long, and half an inch wide. The faces of the crystals were not in the general plane of the fracture, but in various planes; and the comparison of all the pieces fully showed great want of homogeneity in different parts of the gun.

It may, however, be proper to remark in this place, that the committee were convinced, from their own experiments, during the course of this investigation, that the difference of the appearance of the fracture of different pieces of iron, depends very much on the manner in which the breaking has been produced. In two fractures made in the same bar, the one by indenting with a chisel, and then breaking across an anvil, and the other by a gradually increasing pull, the latter exhibited a fibrous structure, without the appearance of a single crystal, while the other was pronounced, by a workman, to be the fracture of a piece of inferior crystalline iron. It also appears from

the experiments of the committee, that although the fibrous fracture indicates a considerable degree of ductility, it can, by no means, be relied on as an indication of the tenacity of the metal. In one case, two pieces of remarkably soft and pliable iron, which exhibited a perfectly fibrous texture, when pulled apart were found to possess about four-fifths of the tenacity of a piece of iron which exhibited, under the same circumstances, a granular texture.

The committee, however, are convinced, that when the fractures are produced in the same manner, as by means of a sudden transverse force, the appearance of the surfaces does afford, to an experienced eye, an indication of the quality of the iron, and that the same appearance offers a ready method of determining the homogeneity of the structure of a large mass.

The next object of examination to be described, was the surface of the original fracture of the large fragment of the breech. This exhibited, in several places, traces of the original bars of which the gun was constructed; also spots indicating a want of perfect continuity in the metal, which was the more evident, as these were, in some cases, covered with a brittle scale of the oxide of iron, of the thickness of a sheet of drawing paper. The position and relative size of one of these spots is shown at *a*, in Fig. I. It is between nine and ten inches long, and in the broadest part three inches wide. It approaches at its nearest part to within three-fourths of an inch of the chamber, and may have extended into it in another plane oblique to that of the general fracture. Within this spot was observed, what, at first, appeared to be an imbedded lump of stone; it was probably, however, a mere scale of slag, since it was lost sight of in the subsequent operation of cutting the iron. The committee think it probable, that from the direction in which the pieces must have been blown from the gun, and other circumstances, that the rupture commenced near this spot, and that it was the approximate cause of the rupture taking place in the plane exhibited, rather than in any other.

Besides the spots indicating a want of continuity in the metal in the plane of the fracture, the edges of many others in different planes were observed; also a wide solution of continuity was shown throughout a cylindrical surface concentric with the bore, and extending, in one place at least, entirely around the fragment. This was evident from the fact, that oil poured in at the upper side, *f*, came out at *a*, after passing through a distance, within the fragment, of about three feet. Another opening in the prolongation of the same cylindrical surface, is shown at *c*. The sides of this were separated to a distance of a quarter of an inch; and, by inspecting these, it was evident that they had never been welded. Into this opening a wire was thrust to the depth of ten inches. From the end of the same opening, a crack extends into the bore of the gun, as is shown in the drawing. At *E*, is shown the section of a small cavity of a triangular form, the longer side of which was about an inch, and the shorter half of that length, which has the appearance of having never been filled up. The large solutions of continuity concentric with the bore, were, in all probability, at the place where the large masses described in the answers

of Messrs. Ward & Co., commenced to be welded on to the longitudinal shaft.

IV.—*Experiments relative to the quality of the material of the Gun.*

In reference to the experiments instituted for the purpose of testing the strength of the iron, it is important, in the first place, to refer to the fact, that the pieces for trial were all cut from the large fragment of the breech, and, therefore, from the immediate part of the gun where the burst occurred. The bar sent to Boston, to be experimented on, by a member of the committee, in that city, was cut from the wall of the chamber lengthwise of the fibre; its position is shown at *g*, in Fig. I. For the purpose of comparison, the same member of the committee was furnished by Messrs. Ward & Co., with two bars of iron taken from the same parcel, and supposed to be of the same quality as that used in the construction of the gun.

The following is a report of the experiments and observations made with these bars in Boston, so far as they have an immediate bearing on the questions to which the committee are restricted. It should be recollected, that they were made by one of the members of the committee, and without a knowledge of the results obtained in Philadelphia by the other members:—

“The bar cut from the body of the gun, was reduced in a planing machine, to the size of two inches square, and was subjected to a transverse strain, supported at both ends, on knife edges, twenty inches apart, and the weight applied in the middle. The different weights applied with the deflections, and the permanent set caused thereby, were as follows:—

Weight applied.	Deflections.	Permanent set.
10800 lbs.	.35 inches.	.30 inches.
12825 “	.61 “	.55 “
13950 “	.94 “	.87 “
15570 “	1.22 “	1.15 “
16650 “	1.52 “	1.44 “
17300 “	1.83 “	1.75 “

“The bar endured this strain without exhibiting any cracks, or other indications of approaching rupture. One of the original bars having the same dimensions, was tried in like manner, and gave similar results.

“By these trials, it appears that so far as respects the quality of stiffness, the iron has undergone no change in the process of forging the gun.

“To determine the tensile strength of the iron, or its power to resist being torn asunder by a force applied in the direction of the length of a bar, three specimens were taken from each of the bars mentioned. Two of the specimens taken from each bar, were reduced to a suitable form for breaking by tension, in a turning lathe, in order to have the material in the same state as it existed in the bars, undisturbed by any heating or hammering. The third specimen from each bar, was drawn down under a welding heat, at a common smith's forge. All of them were reduced, in the part where the fracture would occur, to an uniform diameter of six-tenths of an inch. The following results were obtained:—

I. From the original bars representing the quality of the iron before welding the gun :

1st specimen from bar A, broke with	45,359 lbs. pr. sq. in.	
2d " " " "	45,359 " "	
Mean,		45,359
1st specimen from bar B, broke with	50,930	
2d " " " "	46,155	
Mean,		48,542

II. From the same bar drawn down under a welding heat.

One specimen from bar A, broke with	39,375	
" " " B, "	49,338	
Mean,		44,356

Mean of six specimens from original bars, . 46,086

III. From the bar cut from the body of the gun.

1st specimen from this bar unaltered by heating, or hammering, broke with	40,585	
2d specimen from this bar unaltered by heating, or hammering, broke with	36,606	
Mean,		38,595
One specimen from the same bar, drawn down under a welding heat,		52,521

In order to compare the iron used in the construction of the Princeton's gun, with other kinds of wrought-iron, the following additional specimens were tested.

Russia iron, the common flat bar, one specimen,		62,644
English rolled iron from different bars,		
Banke's, 1st specimen,	56,896	
" 2d "	56,169	
Mean,		56,532
Low Moor, 1st specimen,	58,888	
" 2d "	53,317	
Mean,		56,103
American hammered iron from different bars,		
Bridgewater, Mass., 1st specimen,	58,488	
" " 2d "	49,338	
Mean,		53,913

Recapitulation of all the kinds of wrought-iron tried, showing the actual and the proportional cohesive power of each at one view.

	lbs. pr. sq. in.	Proportional strength.
Russia iron,	62,644	1.0000
English iron, { Banke's,	56,532	.9024
{ Low Moor,	56,103	.8955
American iron,	53,913	.8605
Iron of the Prince- { Original bars,	46,086	.7356
ton's gun, { As in the gun,	38,595	.6161
{ Same reworked,	52,521	.8383

"The results of this examination appear to show that the iron used in forging the Princeton's gun, was originally of an inferior quality,

having only about three-fourths the strength of English iron. It appears also that the original strength of the iron is considerably impaired by the process of welding it into so large a mass as that which formed the gun, the strength before and after welding being about as 6 to 5."

In the opinion of the general committee the specimen of English iron, used in this comparison, is of a good quality, while that of the American is not of the best kind.

The following are the results of experiments made at the Hall of the Franklin Institute, in reference to the quality of the material of the gun:—

I. Experiments with the metal in the state in which it existed in the gun.

1st specimen cut from position marked <i>h</i> , near the bore of the gun, being part of the shaft made of the longitudinal bars; strain lengthwise of fibre, broke with a tension on the square inch of	lbs. 38,400
2d specimen from same place, circumstances same, broke with less than	25,800
Another specimen from position marked <i>k</i> , near the outside of the gun, across the fibre,	31,100
2d specimen from same place, circumstances same, less than	31,100
3d specimen, continuation of the preceding, towards the breech,	41,400
Specimen tangent to circle of bore across fibre of shaft made by the longitudinal bars, from position marked <i>L</i> , broke with	23,700

II. Metal from the gun annealed, but not hammered.

1st specimen from position marked <i>h</i> , lengthwise of fibre of shaft, made of longitudinal bars broke in two places, the first breaking weight being	36,300
And the second breaking weight,	39,100
2d specimen from same place,	32,800

III. Metal from the gun drawn down at a welding heat, under forging hammer.

1st specimen from the position marked <i>m</i> ,	58,000
2d specimen from the same,	68,950

Recapitulation.

1. The average tensile force with which the specimens from the interior of the gun broke, when strained in the direction of the fibre, is less than	32,100
2. The specimen from the interior strained in a direction across the fibre, gave	23,700
3. The specimens from the outside of the gun across the fibre, gave an average of less than	34,533
4. Annealed specimens from the interior, strained lengthwise of the fibre, gave an average of	36,067
5. The average of all the specimens from the gun not hammered, is	33,300

6. The average of the specimens worked down under the hammer, is 63,475

The general conclusions from these results are the same as those from the experiments made by the member of the committee in Boston, so far as the two series can be compared.

1. The average strength of the iron as it existed in the gun from both series, is 33,586
2. The average strength of the iron from the gun, after being drawn down with the hammer from both series, is 59,824
3. The average strength of the original bars from the experiments of the first series, is 46,950
4. The average strength of good American iron, from the investigation of a former committee of the Institute, is 60,000

No experiments were made, at the Hall of the Institute, on the original bars of which the gun was formed. Owing to a misapprehension by Messrs. Ward & Co., of the request of the committee, (see question 7, and its answer,) none of the metal in its original state was sent to Philadelphia. The conclusion, therefore, in reference to the quality of the original bars, rests on the experiments made in Boston. In the accuracy of these experiments, the whole committee have the fullest confidence, and in this point the result is also corroborated by the fact of the large size of the bars, and that there is no evidence that the iron had been piled.

Besides the experiments given in this report, the committee commenced a series of others, on the effect produced in a mass of iron by long heating, without cooling—by heating and cooling alternately—by subjecting the metal for several weeks to a constant vibration, &c., but the committee are not clearly of opinion that they can depart so far from the inquiry to which they were limited.

V.—Conclusion.

From the results of the whole investigation, the following facts are derived:—

1. *The iron of which the gun was principally made, was capable of being rendered of a good quality by sufficient working.*
2. *In the state in which the iron was put into the gun, it was not in a sufficiently good condition for the purpose to which it was applied.*

3. *As the metal existed in the gun it was, decidedly, bad.*

4. *As to the manufacture of the gun, the welding was imperfect.*

These facts relate exclusively to the gun submitted to the examination of the committee, and are derived from immediate experiment and observation; but, besides giving these to the public, the committee feel bound to express the opinion, that in the present state of the arts, the use of wrought-iron guns of large calibre, made upon the same plan as the gun now under examination, ought to be abandoned, for the following reasons:—

1st. The practical difficulty, if not impossibility, of welding such a large mass of iron, so as to insure a perfect soundness and uniformity throughout.

2d. The uncertainty that will always prevail, in regard to imperfections in the welding. And,

3d. From the fact that iron decreases very much in strength from the long exposure to the intense heat, necessary in making a gun of this size, without a possibility, with the hammers at present in use in this country; of restoring the fibre by hammering. At the same time the committee would not wish to be understood as expressing any opinion whether the construction of a safe wrought-iron gun, upon some other plan, is practicable, or impracticable, in the present state of the arts, inasmuch as this subject has not been referred to them by the Department.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, August 8, 1844.

Lunar Occultations.

Lunar Occultations visible in Philadelphia, computed by MRS. CHARLOTTE S. DOWNES, from the Elements published with the Occultation list for the United States Almanac.

The Immersions and Emersions are for Philadelphia, mean astronomical time. Im. for Immersion, Em. for Emersion. These abbreviations in *Italics* refer to those Immersions and Emersions which take place on the Moon's dark limb. N. App. for Near Approach.

The angles are for *inverted image*, or as seen in an astronomical telescope, and reckoned from the Moon's North point and from its Vertex around through East, South, West, to North and Vertex again. For direct vision add 180°.

AUGUST, 1844.

Day.	H'r.	Min.	Star's name.	Mag.	From North.	From Vertex.
1	6	59	Im. 16 Piscium,	6	45°	92°
	8	0	Em.		263	313
1	13	15	Im. <i>m</i> Piscium,	6	350	218
	13	45	Em.		305	324
9	14	41	Im. 15 Geminorum,	6	113	164
	15	34	Em.		245	299
15	11	51	Im. 24 Ophinch,	6.7	102	53
	12	45	Em.		246	193
23	9	8	Im. 33 Sagittarii,	6	120	112
	10	7	Em.		213	193
23	11	31	Im. ζ^1 Sagittarii,	6	42	9
	12	6	Em.		282	243
23	11	21	Im. ζ^2 Sagittarii,	6	127	95
	11	59	Em.		196	158
26	11	8	Im. <i>c</i> ¹ Aquarii,	6	43	14
	12	25	Em.		256	239
28	12	20	Im. α^1 Piscium,	5.6	43	52
	13	40	Em.		251	235
28	12	19	Im. α^2 Piscium,	5.6	81	90
	13	35	Em.		213	202
SEPTEMBER.						
4	15	38	Im. <i>n</i> Tauri,	5.6	59°	111°
	16	57	Em.		290	327
19	8	43	Im. 2150 Bailey,	6.7	70	43
	9	56	Em.		258	220
23	14	28	Im. G Aquarii,	6	43	356
	15	25	Em.		266	217

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AND
AMERICAN REPERTORY.

OCTOBER, 1844.

CIVIL ENGINEERING.

Some account of Leveling Instruments, with a description of one of an improved form. By THOMAS STEVENSON, C. E., Edinburgh.*

The improved spirit level about to be described, was made for me in 1840, by Mr. Adie, and afterwards described in a letter to the Institution of Civil Engineers.†

Since then I have had two levels, of the common construction, altered to the new form. On a late occasion, these instruments were exhibited to the Royal Scottish Society of Arts; and, as no drawings had been laid before the public, that Society requested me to prepare a description with diagrams, that these might be published in their Transactions. In accordance with their request, therefore, I have drawn up the present description; and have also consulted many early writers, to ascertain, as well as I could, the history of one of the most important of geodetical and engineering instruments.

There unfortunately exists a great deal of conflicting evidence regarding the true inventors of the different parts of the spirit-level. Indeed, there are hardly two authorities who agree upon the subject.

The great Huygens appears to have been the first to *apply the telescope to a level* of his, which was constructed on the principle of the plummet. This is noticed in the life prefixed to his works,‡ in

* Exhibited and verbally described to the Royal Scottish Society of Arts, on the 22d January, 1844; and this written description requested.

† Engineer and Architect's Journal, vol. v.

‡ Christ. Hugonii Op. Var. Lugd. Batav. 1724.

the following terms:—"Ibi" (Lutetiæ) "vixit ab anno 1666 ad annum 1681. Durante hoc tempore pulcherrima subtilissimaque multa in mathematicis detexit variaque ex iis operibus conscripsit quæ nunc in unum corpus collecta quid in variis Matheseos partibus præstiterit sub oculis ponunt. Præter ipsius jam memorata inventa præclara inter alia duo insigni usu eminent. *Libellam telescopio munitam* ita construxit ut ipsi præ ceteris fides haberi possit," &c.

The honor of having first applied the *air-bubble* to the determination of horizontality, seems to be due to that universal genius Dr. Hooke. From all that I can gather, it appears that his invention must have been made subsequent to 25th March, 1674, and prior to the year 1675, as, in his "Attempt to prove the Motion of the Earth by Observations," of date 25th March, 1674, he describes a new method of *stilling the plummet*, by immersion in water. While in his animadversions,* published also in 1674, after fully describing his invention of the air-bubble confined in a tube, he speaks of its peculiar advantages, and great delicacy of movement, and remarks,— "This can hardly be performed by the ordinary way of plummets, without hanging from a vast height, which is not practically to be performed without almost infinite trouble, expense, and difficulty," &c.

Hutton, in his Mathematical Dictionary, remarks, that the application of the air-bubble to the level, "is said to be due to M. Thevenot," but with what justice I cannot say, having been unable to meet with any reference to this instrument in the writings of that author. Thevenot was born in 1621, and he died in 1692.

I have been unable to discover who was the inventor of the *circular level*, which, I imagined, had been of recent date; but Switzer, at page 91, of his Treatise on Water-Works, which was published in 1734, remarks, that the circular level was then employed in the construction of the surveying instrument called a plane-table.

According to Sir John Herschel, *the cross-hair*, which gives so much accuracy to all astronomical, as well as leveling, instruments, was the invention of Gascoigne, a young Englishman, who used it in 1640. He was killed, at the age of 23, at the battle of Marston Moor.

M. Le Bion† appears to have been the first to *conjoin the telescope of Huygens with the air-bubble* of Dr. Hooke; and this must have been subsequent to the year 1684, as such an instrument is not shown in De la Hire's edition of Picard's Treatise on Leveling.‡

But it was not till Sisson's improvements that the level could be considered as in any way an accurate, or philosophic, instrument.

* Animadversions on the first part of the Machina cælestis of the Hon., learned, and deservedly famous Astron. Johannes Hevelius, Consul of Dantzick, together with an explication of some instruments made by Rob. Hooke, Prof. Geom. in Gresh. Coll., and F.R.S. Lond. 1674, p. 61, *et seq.*

† Traité de la Construction et des Principaux usages des Instrumens de Mathématique. Par N. Le Bion, Ingenieur du Roi pour les Instrumens de Math. Nouv. Edit. a la Haye, 1723.

‡ Traité du Nivellement Par M. Picard, mis en lumière par les soins de M. De la Hire, 12mo. A Paris, 1684.

All that were made previous to this time were coarse instruments, adjusted by a ball and socket, and, in other respects, resembling the common perambulatory survey-level, which, from the nature of the construction, can be leveled in only one direction, and cannot be reversed, or moved, even in the slightest degree, without requiring re-adjustment. Sisson may, therefore, be considered as the inventor of the instrument in common use. The main feature in his improvements was the introduction of the four screws called the *parallelplate screws*, (D, in the diagram.) I have been unable to find out the date of Sisson's improvement; and, indeed, the only notice I can find of him is the following in Switzer's System of Water-Works:—"The invention," alluding to the instrument with parallel plate-screws, "as I take it, (for I am not as yet well acquainted with that gentleman,) of William Sisson, at the corner of Beaufort Buildings, in the Strand."*

Since the time of Sisson, the celebrated Ramsden introduced a tangent screw and clamp, for moving the instrument with accuracy through small distances in an arimuthal direction. Messrs. Troughton and Simms also made several improvements in the arrangement of the various parts of the instrument; and Mr. Gravatt, has, of late years, added a cross-bubble for facilitating the *rough-setting* of the instrument—or that adjustment which is made with the legs of the tripod; and an enlargement of the diameter of the object-glass, so as, by the admission of a greater number of rays of light, to allow of the telescope being shortened, without impairing its optical powers.

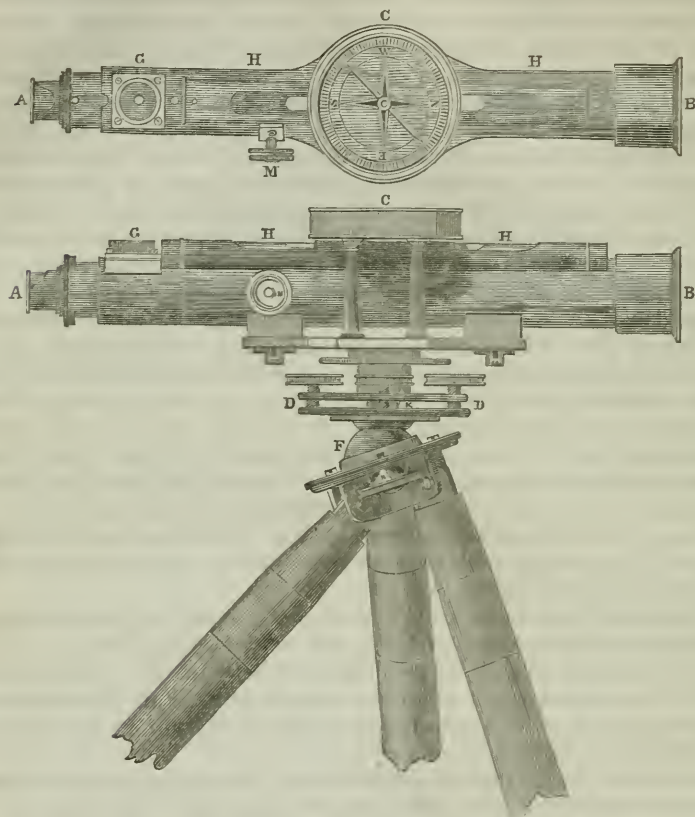
Having thus endeavored to describe the successive changes which the level has undergone, I shall now proceed to notice the nature of the present improvements.

The first of these is the substitution of a circular, or, to speak more correctly, a *spherical* level, G, sluggish in its motions, instead of the small cross-level, which was introduced by Mr. Gravatt. The advantage of the circular level over the common form, is its peculiarity in at once showing the deviation of the instrument from horizontality in both directions, instead of only one.

Before describing the next improvement, it may be proper to state, that the clumsiness of the common level consists in its being at all dependent on the setting of the legs. This arises from the circumstance of the ball and socket motion, K, being controlled in its action by the parallel plate screws of Sisson, D, the consequence of which is, that, in using the common level, care must be taken to set the instrument very nearly level *by the eye*, so as to be within the range of the parallel plate screws, D, otherwise it is impossible to adjust the instrument. And, although to the practical man, the trouble attending this may be comparatively small, still he will admit that it is one of the most irksome parts of the whole operation of leveling; to say nothing of the time that is lost in adjusting the instrument afterwards, with the parallel plate screws. What appeared to be wanting was a motion for the preliminary, or *rough-setting*, intermediate in nicety between those of the parallel plate screws, and of the legs. In order

* An Universal System of Water and Water-Works; by Stephen Switzer, 2 vols. 4to. Lond. 1734.

to gain this end, a ball and socket motion, F, having a clamp, N, is introduced in addition to the ball and socket, K, whose action is limited by Sisson's parallel plate screws, D, so that my improved level has two ball and socket movements.



A B, is the telescope; C C, the compass box; M, the screw for adjusting the focus; H H, the tubular spirit-level; G, the spherical, or circular, level; D D D, the parallel plate screws of Sisson; K, the old ball and socket motion; F, the new ball and socket motion; N, clamping screw for socket motion.

With the instrument thus improved, the observer is made quite independent of the level of the ground where he sets the legs of his instrument, and may place them without regard to the inclination of the telescope to the horizon. Looking first to the circular level, G, and releasing the clamp, N, of the ball and socket, F, he, with one hand, moves the head of the instrument till the bubble is in the centre of the circle, an operation which is done almost instantaneously.*

* In the annexed plan the instrument is shown off the level, so that neither the air-bubble of the circular level, G, is in the centre of the circle; nor does the air-bubble in the tube, H H, correspond with the file-marks made on the glass.

The socket screw, N, is then clamped, and the telescope bubble H H, is brought to the *absolute* level by a slight touch of the parallel plate screws, D. In this way the legs of the tripod never need to be moved after the instrument has been placed on the ground, and the parallel plate screws have almost nothing to do—advantages which all who are accustomed to leveling will fully appreciate.

In leveling over mountainous districts, it very often happens that it is desirable to select a station where the ground is so rugged and precipitous as to render it difficult, if not impossible, to find three points for the extremities of the legs of the instrument to rest on, which shall be on such levels as to bring the telescope within the range of the parallel plate screws; *but wherever the instrument can be made to stand with safety, the bubble of the improved level can be adjusted, and adjusted in exactly the same time, and with exactly the same ease, as if the instrument were placed on level ground.*

Another advantage of these improvements is the removal of a great practical difficulty which is often experienced on sloping ground. The instrument being set and properly adjusted, the observer, on looking through the telescope, may discover that he is not within the range of the leveling staff; in other words, he has chosen a station too high, or too low, to admit of his seeing any part of the staff within the field of the object-glass. The only remedy for this is to choose a new station where the instrument must be again set up and levelled, at a great expense of time and trouble. In order to remedy this, it was my intention at one time to have fixed on the telescope a French level, on the principle of the plummet, in order speedily to discover, before making the adjustments, whether the intended station were within the range of the staff, or not. But the instrument can be roughly set with so much quickness, by means of the additional ball and socket, that the French plummet may be considered as being now scarcely necessary.

In my letter to the Secretary of the Institution of Civil Engineers, I pointed out the advantages which would result to the surveyor, were the theodolite provided with a second ball and socket motion; but no opportunity of trying this has as yet occurred.

Edinburgh New Philos. Journ.

Mineral and Metallic Statistics.

By the returns to five several orders made by the House of Commons, which were obtained by the exertions and perseverance of Sir J. J. Guest, Sir C. Lemon, and Mr. Evans, (M. P. for North Derbyshire,) we are enabled to lay before our readers a most correct account of the various exports and imports of iron and iron ore, hardware, cutlery, &c., copper ore, copper, tin, zinc, lead ore, and lead, for the year ending January 5, 1844.

Commencing with iron, it appears there was imported in the year, iron ore 131 tons, chromate of iron 1393 tons, pig-iron 243 tons, un-

wrought iron in bars 12,795 tons, bloom 563 tons, rod-iron 12 tons, old, broken, and cast-iron 286 tons, cast-iron only 8 tons, steel unwrought 1697 tons—of these, 97 tons only were entered by weight, the remainder by value, 11,035*l.* 6*d.* 9*d.* Of the several countries from which these importations came, the principal is Sweden, whence we have received of iron 10,909 tons, and steel 1558 tons, leaving but a small portion to divide between twenty other places. Our exports of foreign iron have been, unwrought in bars 3986 tons, rod 10 tons, hoops 2 tons, cast-iron 11 cwt., steel, unwrought, 1456 tons. The total quantity of foreign iron retained for home consumption was 14,782 tons, upon which the net amount of duty was 14,563*l.* The exportation of that staple produce of our own country, British iron, was as follows:—bar-iron 176,148 tons, bolt and rod 22,625 tons, pig-iron 154,770 tons, cast-iron 16,449 tons, iron wire 1508 tons, wrought-iron, consisting of anchors, grapnels, &c., 3058 tons, hoops 14,591 tons, nails 6020 tons, and all other sorts, except ordnance, 44,577 tons, old iron for manufacture 5924 tons, and unwrought steel 3199 tons. Those places which have taken the greatest portions of this produce are Russia 10,963 tons of bar-iron; Denmark 10,447 tons bar, and 7010 tons pig; Prussia 12,009 tons bar, 17,480 tons pig; Germany 13,298 tons bar, 6322 tons pig, 1339 tons cast; Holland 17,509 tons bar, 75,953 tons pig, 4317 tons cast; Belgium 4279 tons cast; France 4237 tons bar, 22,103 tons pig; Italy 21,930 tons bar, 3982 tons bolt and rod, 3005 tons pig; Turkey and Continental Greece 6412 tons bar; East Indies and Ceylon, 20,620 tons bar, 2967 tons bolt; British North American Colonies 6837 tons bar, 1995 tons cast; foreign West Indies 5043 tons bar, 1646 tons cast; and to the United States 21,336 tons bar, and 7148 tons pig. The largest quantity of unwrought steel has been to the latter place, viz., 1336 tons.

Of British hardware and cutlery, we exported, in the year, 17,183 tons, valued at 1,745,518*l.*; the principal of which has been, to Germany 1237 tons, value 159,889*l.*; East Indies 1402 tons, value 142,607*l.*; British North American Colonies 1129 tons, value 102,260*l.*; British West Indies 997 tons, value 80,040*l.*; foreign West Indies 657 tons, value 48,609*l.*; United States 4282 tons, value 448,341*l.*; Brazil 943 tons, value 80,070*l.*; and divers other places, varying from 100 to 500 tons.

We now come to copper. Of foreign copper ores we have imported 55,720 tons; and of metallic copper, unwrought and wrought plates, and coins 805 tons. Of the ores, the greatest quantities have come from Cuba and Chili; from the former 31,683 tons, and the latter 19,829 tons; 54,370 tons of this ore has been retained for home consumption, the net amount of duty received thereon being 64,445*l.* 3*s.* 5*d.* The total of British copper exported, from twenty-three ports, was 17,515 tons, of which London sent 6469 tons, Swansea 4502 tons, and Liverpool 5587 tons; France took 4891 tons, the East Indies 6125 tons, and the United States 1473 tons. The total quantity of foreign copper exported was 672 tons. Of the above 17,515 tons of British copper, 8163 tons were unwrought, in bricks and pigs; 60 tons of coin; sheets, nails, &c., 8386 tons; wire 6 tons; and other sorts

of wrought-copper 597 tons. Previous to the 9th of July, 1842, the whole of the copper smelted in the United Kingdom from foreign ore was but 262 tons. Of foreign copper ore, containing not more than 15 per cent. of metal, we imported 14,083 tons, on which the amount of duty was 5460*l.*, charged on 1733 tons of metal; under 20 per cent. and more than 15 per cent. 13,304 tons, duty 10,339*l.*, charged on 2188 tons of metal; and, above 20 per cent., 26,969 tons, duty 48,630*l.*, charged on 7719 tons of metal.

Our importations of tin have been as follows:—

Countries from whence imported.	Tons.	Cwt.	Qrs.	Lbs.
Holland, ...	14	3	2	8
Gibraltar, ...	0	1	0	0
East Indian Territory, . .	129	7	0	26
Singapore, ...	1115	7	2	18
Java, ...	272	12	3	17
China, ...	0	6	0	0
Peru, ...	27	7	3	21

Total import of foreign tin, 1559 6 1 6

We have exported 1819 tons of British, and 650 tons of foreign tin—of which France has taken 626 tons, Russia 480 tons, Italy 183 tons, Turkey 250 tons, and the remainder distributed among twenty-seven places.

Of foreign zinc, we have imported as follows:—

Countries from whence imported,	Tons.	Cwt.	Qrs.	Lbs.
Denmark, ...	268	19	2	21
Prussia, ...	6860	15	3	22
Germany, ...	3000	1	2	11
Holland, ...	20	3	2	1
Belgium, ...	21	0	0	9
Syria and Palestine, . . .	1	15	0	15

Total import of foreign zinc, 10,173 4 3 23

Of this we retained for home consumption 4102 tons, on which the net duty was 223*l.* 2*s.* 10*d.*; and we have exported 1395 tons of British, and 6445 tons of foreign spelter.

Of foreign lead, we have imported 2863 tons—of which 2775 tons were pig and sheet, 68 tons ore, and 19 tons white lead; 157 tons were retained for home consumption, on which the duty was 165*l.*; and we imported from the Isle of Man, duty free, 2415 tons of lead ore. Our exportation of foreign lead amounted to 2439 tons—while of British we exported 176 tons of ore, 14,610 tons pig and sheet, 378 tons litharge, 707 tons red lead, and 1224 tons white lead—making a total of 17,097 tons.

Lond. Min. Journ.

Copper Mining in Cornwall.

Fowey Consols.—This sett, which is 1500 fathoms in extent on the

run of the lodes, and extending 300 fathoms north and south, is held at 1-24th dues for the western ground, which includes the old Lanescot Mines—and at 1-16th for the eastern part, but which, it is expected, will be reduced to 1-24th, as the lease is drawing to a close, and negotiations pending for such abatement on renewal. The mine presents at surface the most complete and efficient arrangements for economizing labor, the buildings, dressing floors, &c., with yard for stores and ware-houses, smiths' and carpenters' shops, &c., being immediately under the eye and control of the agents. The principal power employed here is by means of water-wheels and hydraulic engines, the combined power of which is 556 horse, which does not embrace the whole of the power which is available.

The following is a description of the several water-wheels:—

Name.	Diam. feet.	Breadth. ft. in.	Horse power.	Application.
Remfry's wheel,	30	3 6	32	Drawing ores to surface, also coal, timber, &c., from canal over incline plane, and tunnel, 900 yards long.
Old stamps wheel,	19	4 0	22	Stamping halvans, and working incline plane for drawing ores to crusher.
Timber sawing wheel, 27		2 6	18	Twelve vertical and one circular saws; power for twenty, if necessary.
Sampson's wheel,	24	3 0	27	Drawing ores to surface.
Old grinder wheel,	24	3 8	30	Crushing.
Separator wheel,	24	1 9	15	Jigging.
Great grinder wheel,	27	6 0	60	Stamping.
Wheal Hope wheel,	40	3 6	60	Stamping.
New stamps wheel,	30	6 0	65	Stamping.
Tremayne's wheel,	24	4 0	27	Drawing.
Fitting up wheel,	14	2 6	5	Turning lathes, &c.
New separator wheel,	12	1 6	4	Jigging.
Pidler's wheel,	34	5 0	60	Pumping.

Giving a total of 425 horse power by water-wheels. To this is to be added the hydraulic engines employed in pumping; these are three in number, viz., Bottrall's 24-inch, equal to 49 horse power, with column of water 30 fathoms in height; Union, 22½ inch, 52 horse power, column 45 fathoms high; and Hodges', 18 inch, 30 horse power, with column of 19 fathoms; thus making the total water power equal to 556 horse.

The steam engines employed consist of—

Name.	Cylinder. inches.	Length of stroke.				Horse power.	Application.
		ft.	in.	ft.	in.		
Austen's,	80	10	4	9	3	200	Pumping.
Davis',	22	5	0	5	0	30	Drawing.
Powne's,	22	5	0	5	0	30	Drawing.
Trathan's,	20	4	0	4	0	22	Drawing.
Ray's,	18	4	0	4	0	15	Drawing.
Hodges',	24	5	0	5	0	30	Drawing.

It will thus be seen, that in addition to the water power, the steam employed is equal to 327 horse power, estimated according to Boulton and Watt's calculation—but which is considerably greater with the Cornish improvements; thus making, in the aggregate, a power

equal to 883 horse applied at surface. The quantity of water brought to the mine by leats is estimated at not less than 25,000 gallons a minute in the winter season, and about 10,000 in the summer.

The number of lodes discovered and worked upon exceed twenty, of which workings are now being carried on thirteen, or fourteen; there are six engine shafts, the principal of which (Austen's) is sunk to a depth of 180 fathoms below adit, which is, at this particular point, about forty-five fathoms from the surface. The quantity of ore sold in 1842, was 12,446 tons, yielding 73,214*l.*, or 5*l.* 17*s.* 6*d.* per ton—the amount divided between the adventurers being 6400*l.* In the past twelve months ending December, 1843, the total quantity of ore was 13,450 tons, or an excess of about 1000 tons, which realized 80,852*l.*, or 6*l.* per ton—the dividends paid to the adventurers being 9728*l.* It may here be mentioned, that, after payment of the first outlay, a sum slightly exceeding 200,000*l.*, has altogether been realized as surplus, in which, however, is included the reserve fund, applied to working the mine; this is exclusive of the value of the machinery and appliances, which may be fairly estimated at 60,000*l.* The mine, since the great increase of the foreign ores, and the consequent fall in the standard, by stopping numbers of old pitches, which cannot work at a low standard, has fallen off in its surplus returns—the quantity of ores raised in 1838, being 15,771 tons, which yielded 95,190*l.* in money, or 6*l.* 0*s.* 6*d.* per ton—the dividends declared in which year were 17,408*l.*, being nearly double the amount divided in the past year. The number of persons employed is from 1700 to 1800, and which may be thus divided:—agents, engineer, and dialler, 17; tributers, 420; tut workmen, 310; sumpmen, day laborers, and boys, underground, 175; laborers at surface, paid by day, 180; women, boys, and girls, at surface, 670—or, in all, 1772. The following may be taken as the average rate of wages paid:—tributers, who work away the lode, earn about 2*l.* 12*s.* per month—the rate of earning being, in some instances, double that of another, arising from the nature of the ground, and the comparative productiveness, or poverty, of the lode; tut workmen, who are employed by bargain in driving ends, sinking shafts, winzes, &c., earn about 2*l.* 15*s.*; the sumpmen may be set down at 3*l.* 10*s.* per month, the increase arising from the nature of the work, which is oftentimes attended with considerable danger, and at all times may be said to be the hardest duty in the mine; the boys underground, 17*s.* 6*d.*; day laborers, or men employed underground, not by bargain, 50*s.* per month, and those at surface, 40*s.*; boys at surface average 20*s.*, and maidens average about 16*s.*, being as low as 8*s.* 6*d.*, and as high as 23*s.* 6*d.* A deduction is made from the earnings towards the sick club, and for medical attendance. As illustrative of the economy observed by the application of mechanical power, it may be remarked, that not more than two or three horses are employed. The length of the inclined plane from the mine to the canal communicating with Par Harbor, is about 900 yards, the incline being in perpendicular height 280 feet; the other incline on the mine for drawing ores to the crusher, is 220 yards in length, and another inclined plane, on the self-acting principle, which takes all the ores of

the mine to the canal in its way to Par Harbor, is 1127 feet long, and 80 feet in perpendicular height. We must needs defer until our next, further observations on this mine and the district.

Ibid.

Remarks on the Theory of Arches, made before the Institution of Civil Engineers, London. By GEORGE RENNIE, Esq.

Mr. Rennie concurred in the accuracy of the description of the Wellington Bridge; it presented an excellent example of theory and practice, not only on account of its strict conformity with the principles of equilibrium, but from the correctness with which the works had been executed, as was evinced by the small subsidence of the arch after the centres were struck. Respecting the theory of the arch, writers were nearly agreed upon the principle established by De la Hire, upon the equilibrium of a loaded chain, or of a series of voussoirs, or wedges, with polished touching surfaces, as shown in his "*Traité de Mécanique*," in 1695.* The subject had been variously demonstrated by writers, but with little effect; architects were forced to select examples at random, for which no precise rules existed; but any persons on examining the actual state of an equilibrated arch of solid materials, or of a substantial chain suspended at its extremities by points, would immediately perceive the difference in the curves, or loads, on the extrados, arising from the want of sensibility in the arch, or, in other words, from friction and adhesion. Hitherto theory had been unable to comprehend these retarding forces, which had actually been so serviceable to the architect. Perronnet was, perhaps, the first to throw any real light upon the subject; the experiments that he undertook, on the absolute strength of materials, in the year 1758, previously to the commencement of the celebrated bridge of Neuilly,† and, subsequently, those by Gauthey, on the failure of the piers of the church of St. Geneviève,‡ at Paris, were very instrumental in the advancement of the art. It was, however, chiefly owing to the good quality of the material, that Perronnet was enabled to surmount the difficulties which arose from the unusual subsidence of the arches in the bridge of Neuilly. The splaying of the arches, by which a double curvature was given to them, and which had been injudiciously copied in this country, was neither justified by science nor practice. The results of the French experiments were much too slow in reaching this country, and the strength of building materials was but little attended to, until within a recent period.

In the year 1824, the late Dr. Thomas Young, having engaged to contribute the article "Bridge," to the Supplement of the sixth edition of the "*Encyclopædia Britannica*," applied to Mr. Rennie, to furnish the particulars of the Waterloo and Southwark bridges, then just completed; when, finding the data insufficient, Mr. Rennie undertook

* "*Traité de Mécanique*." De la Hire. 12mo.: Paris, 1696.

† "*Description des projets et de la construction des Pons de Neuilli, de Nantes, d'Orléans &c.*" Perronnet. 4to.: Paris, 1778.

‡ "*Construction des Pons*." Gauthey. 4to: Paris, 1809.

a series of experiments on the absolute and relative strength of materials, part of which he communicated to Dr. Young, and he, subsequently, published the whole in the Philosophical Transactions for 1818.* The results were then applied to the calculations, on the lateral thrust of the arches of those bridges, perhaps for the first time in this country, and which were more amply applied afterwards to bridges in general, by Mr. Ware, and his tables of the relative boldness of brick, stone, and iron bridges, were valuable accessions to our knowledge on this subject.† As regarded the friction of arches, Mr. Rennie found that the arch stones of Waterloo and New London bridges commenced gliding, or pressing, upon the centres, at angles of from 33° to 34° ; he believed that soon after the adhesion of the mortar commenced, the centres would have very little pressure on them, even from stones at an angle of 45° . As to the gliding of the arch stones at the haunches, from the pressure of the upper voussoirs, he had never seen an instance of it; but he had seen the haunches so much eased from the centres, by the lateral action exerted in driving the stones into the vertex of the arch, as to allow the lagging, or cross bearers above the ribs, to be taken out. This proved the correctness of the rotative system of voussoirs, as shown by experiment. With respect to adhesion, Mr. Rennie had seen its effect on broken arches of considerable magnitude, among the buildings of Rome, and also in the bridge of Alcantara, over the Tagus, where the centre arch, of nearly 100 feet span, had been blown up by the French, leaving the adjoining arches and piers, which were upwards of 90 feet in height, standing perfectly undisturbed. With respect to the magnitude of arches, M. Perronnet expressed himself confident that arches of 500 feet span could be safely executed. The bridge which he proposed to construct, over a branch of the Seine; at Melun, consisted of a segment of a circle of 400 feet. The experience he had derived from the length of the primitive radii of the arches of the bridge of Neuilly, and his experiments on the strength of materials, would appear to justify so bold an experiment.

Mr. Rennie was of opinion, that with our strong magnesian limestones and hard granites, arches of larger span than any hitherto built, might be safely constructed. There were numerous examples, both in ancient and modern times, of very large arches. The bridge of Narni, in Italy, of Vielle Brioude, in France,‡ and of Alcantara, in

* Vide "Philosophical Transactions," 1818, p. 118.

† Vinc "A treatise on Arches, and their abutment piers," by Samuel Ware. 8vo: London, 1809.

‡ The following dimensions of the Pont de Brioude, are given in a letter from M. Seguin to Mr. Rennie, dated Feb. 27, 1827:—"The ancient bridge was constructed by the Romans, for the use of foot passengers, pack mules, and small carts drawn by oxen.

	Metres.		English feet.
Length of the arch,	56	=	183.730
Breadth "	5	=	16.005
Height "	18 to 19	=	59.058 to 61.359

"The arch was a segment of a circle, formed of volcanic stone, of little consistence. The bridge gave way in the course of time, but was upheld for fifteen years, by means of buttress walls, 6 metres (= 21.68 English feet,) in thickness, and 10 metres, (= 32.8 English feet,) in height; and also by bars of iron, fixed in the wing wall, and through several courses of the

Spain, by the ancients; and those of Gignac, and of Castel Vecchio, by the middle ages; but the most remarkable example of cylindrical vaulting, (the remains of which still existed) was the bridge of Trezzo, over the Addu, in the Milanese.* The span was 251 feet over the chord, and 266 feet over the semi-circle. The stone beams in the church of the Jesuits, at Nismes, and those between the towers of Lincoln Cathedral, the former equal to the segment of an arch of 565 feet span, and the latter to one of 262 feet span, proved how much could be done with materials of small dimensions.† In modern times there were examples of bold vaulting in France, in the bridges of Neuilly, Mantes, St. Maixence, and Jena; in Italy, in the Ponte Sta. Trinita, Turin; in England and Wales, in the bridges of Llaurwst, of Pont-y-tu-Prydd, of Gloucester, of Chester, and those of London and Waterloo, over the Thames; independently of numerous arches and viaducts, more recently erected for the use of railways. The radii of curvature of the centre arch of New London bridge, taken near the vertex, would equal, in boldness, an arch of 333 feet; and the length of the key-stone, at 4 feet 9 inches, would make the depth only $\frac{1}{70}$ th of the whole span.

The origin of the arch had occasioned much controversy. The subject had been learnedly investigated by Dutens, Le Roy, King, and others, but, apparently, to little purpose, as the invention of the arch would now appear to be, with more justice, attributed to the Egyptians, as they seemed to have used it many centuries before the Christian era. The researches of modern travelers, particularly those of Sir Gardiner Wilkinson,‡ proved that the brick arch was known in Egypt in the reign of Amenoiph I, 1540 years B.C., and the stone arch in the time of Psamaticus II, 600 years B.C. "The most remarkable," says Sir Gardiner Wilkinson, "are the door-ways surrounding the tanks of Assassief, which are composed of two, or more, concentric semi-circles of brick, as well constructed as at the present day, and all the bricks radiate to a common centre." Mr. Hoskins was of opinion, that arches were constructed long anterior to the time of the Ptolemies; for in the pyramids of Ghebel Birkel and Duukalie, which were of more ancient date, both round and pointed stone arches were discovered. Mr. Perring stated that he found at Thebes, some remarkably well formed arches of 12 to 14 feet span, built in concentric half brick rings, the bricks of which were marked with the name of Sesostris; consequently they were upwards of 3180 years old.|| A

arch-stones. The structure finally fell, and a new stone bridge has been erected upon the same site, of which the following are the dimensions:—

	English feet.
Opening of the arch, which is a semi-circle,	150.9
Breadth of " "	24.7
Height from the stream to the pavement,	83.7

* A section of this arch is shown in Part I, of the "Theory, practice, and architecture of Bridges." Hann and Hosking. 8vo: Weale. London, 1839.

† Robinson, in his "Travels in Palestine," mentions the remains of an arch over the valley of Kedron, at Jerusalem, supposed to have been 350 feet span.

‡ "Manners and Customs of the Ancient Egyptians." Wilkinson. 3 vols., 8vo: London, 1837.

|| Vide Minutes of Proceedings, Inst. C. E., for 1843, p. 170.

representation of the tomb of Saqqura, and its arched vault of stone, was given in the vignette of the tenth chapter of the third volume of Sir Gardiner Wilkinson's "Manners and Customs of the Ancient Egyptians." The arch seemed to have been known to the Etruscans; and from the representations of their palaces, and their sea-ports, the arch appeared generally to have been employed for moles and jetties. With reference to the knowledge of the arch among the Greeks, opinions were very contradictory. The researches of modern travelers had brought to light many curious remains of Cyclopean, or Pelasgic, architecture; but in confirming the descriptions of the ancient cities of Mycenæ and Orchomenos, they had left us still in ignorance as to their actual knowledge of the arch.

Mr. Rennie exhibited a series of lithographic prints, from drawings made by the late Mr. Dodwell, during his travels in Greece. They displayed the various door-ways of Pelasgic fortifications, from the lintel of single stones resting on upright jambs, to the overlapping of the stones until they reached each other, in the form of a triangle, as in the gate of the lions, the entrance into the treasury of Atræus, &c. But the most remarkable monument was the subterranean chamber, of which Mr. Dodwell's lithographic plate gave an imperfect idea; complete plans and sections of that extraordinary building were given by Mr. Donaldson, in the supplement to the "Antiquities of Athens,"* from which it appeared to have been constructed in the form of a parabolic cone of 48 feet in diameter at the base, and 44 feet 6 inches in height, by means of rings of regular masonry, overlapping each other until they reached the apex, where the aperture was closed by a flat stone. From this, and other buildings of a similar kind, there was reason to infer that the ancient Greeks had very imperfect notions of the arch. Mr. Kinnaird, in his "Description of the Antiquities of Delos,"† gave a representation of a portal, or gateway, on the ascent of Mount Cynthus, formed to support the wall of the ancient fortifications. The entrance was constructed with ten large stones inclined to each other, like those at the aperture into the great Egyptian pyramid. It was, perhaps, the earliest specimen of Pelasgic architecture in Greece, displaying the first step towards the principle of the arch. That it was known by the Etruscans, seemed evident, from the remains of arches and bridges, now existing in the country of the Volsci in Italy; and the researches of travelers in that country, within the last few years, had brought to light many curious examples, anterior to the period of the Cloacæ of Rome, and the tunnel of Albano, by Ancus Martius. Mr. Rennie was of opinion, from his examination of the subject, that there existed no sufficient evidence to establish the knowledge, or use, of the arch among the Greeks.

Mr. Page presented two sketches made by him of two arches at Cape Crio, (Cnidus, Rhodes.) These arches were semi-circular, built of large stones regularly radiating from a centre, without any mortar in the joints, and stood among Cyclopæan remains, of which they apparently formed a part. He was of opinion, that the Greeks were

* "Antiquities of Athens," &c. Stewart and Revett. Supplement. Folio. London, 1830

† "Antiquities of Athens," &c. Stewart and Revett. Supplement. Folio. London, 1830

aware of the properties of the arch. They evidently appreciated its form, for it must have been noticed by all travelers, how frequently the flat lintels were cut out on the under side; several specimens of this existed in the sepulchral remains now in the British Museum. At Athens, he had noticed a very considerable excavation of a regular arch form through solid marble.

Mr. Rennie observed, that as more useful lessons were given by failures in construction, than by records of successful undertakings, he had caused a large drawing to be made of the bridge of Boverie, at Liège, showing its state at the time of the report upon it, by the commissioners appointed by the Belgian government, when it was condemned, and was ordered to be reconstructed, at the cost of the contractor, which, however, had not yet been done. The bridge, which was built of hard, compact, magnesian limestone, consisted of five arches of 78 feet span each, with a versed sine of 8 feet, which was between $\frac{1}{9}$ th and $\frac{1}{10}$ th of the span. The form of the arch was that of a segment of a circle of 100 feet radius, the angle of the springing was, therefore, $46^{\circ} 45'$. The abutments at either extremity were of rubble masonry, and were very deficient in weight and dimensions. The obvious consequence of this want of due proportion was, that the abutments gave way, all the arches sunk at their centres, many of the stones nearly falling out, several of them were fractured in both directions, serious dislocations occurred in each pier above the springings of the arches, and also down upon the cutwaters, and, in spite of all attempts to remedy the defects, the bridge was condemned, and was taken down, although it had cost upwards of £25,000. It was evident that these flat arches were not well proportioned, and that the abutments were insufficient to support their thrust. It appeared also, from the report of the commission, (of which he presented an abstract, No. 672,) that sufficient attention had not been paid to the quality of the workmanship, or in the selection of the materials employed.

Civ. Eng. and Ar. Journ.

On the Reduction of Inclined to Horizontal Angles. By Lieut. A. G. EDGE, R.N.

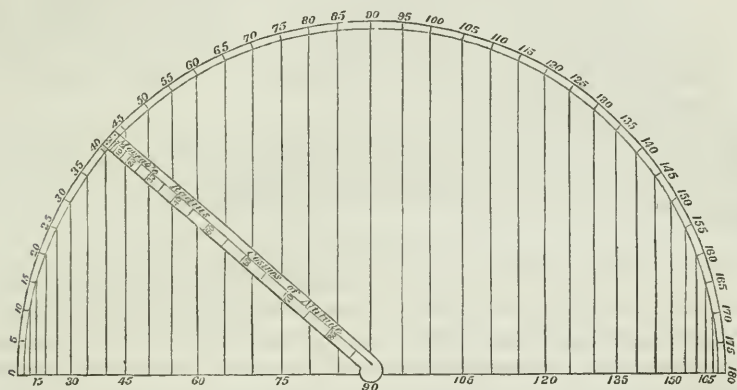
The accompanying simple diagram having suggested itself to me, for the speedy reduction of the inclined angle between the sun and an object, to the horizontal angle, I take the liberty of forwarding it to you, with an example of its application to practice, for insertion in your useful Magazine.

The principles of this diagram are lines of cosines, drawn on a semi-circle, and which I call cosines of distance. To the centre of this semi-circle is attached a movable radius, which is also divided into cosines, called cosines of altitude. The following example will show its use: Suppose the true angular distance between the sun's centre, and the object, to be $45^{\circ} 0'$, and the sun's corrected altitude $20^{\circ} 0'$.

To the *cosine of distance* 45° on the semi-circle, bring the *cosine of*

altitude 20° on the movable radius, and you will find that the extremity of the movable radius on the arc will be found at $41^\circ 12'$, within a few minutes, for the reduced angle; if the lines of cosines on the semi-circle and radius are correctly drawn, and their scale sufficiently large, the reading off will be the same as if the operation were performed by logarithms.

The diagram I send you is of small radius, for convenience of insertion, and only divided at every 5° , but for practical use the larger the scale on which it is constructed, the greater will be the accuracy of reading off; every degree and quarter degree, at least, should be drawn in lines of cosines.



A diagram carefully drawn on card board of eighteen inches radius would be found to approach pretty near the truth; but, of course, greater accuracy would be obtained if it were made on a metal plate.

The usual method of reducing Sun's Hor. $\angle$ is as follows:—

Take, for example, Cor. Dist. Sun, and object 45° , Alt. Sun. 20° .

Dist. $45^\circ 0'$ Cosine 9.849485

Alt. $20^\circ 0'$ Secant 0.027014

Red. Hor. $\angle \odot 41^\circ 12'$ 9.876499 cosine.

The principle on which the diagram is constructed, being lines of Cosines,

Dist. $45^\circ 0'$ Cosine 9.849485 + 10 to index.

Alt. $20^\circ 0'$ Cosine 9.272986

Red. Hor. $\angle \odot 41^\circ 12'$ 9.876499 cosine.

In the application of this angle to the sun's true bearing, (supposed to be already found) + or—according as the object is to the right, or left, of the sun's centre, it would, in strictness, require a further reduction for the convergency of meridian, but, in practice, under ordinary circumstances, this might be dispensed with, the quantity of correction being but small.—[We commend the foregoing to the attention of nautical surveyors.]

AMERICAN PATENTS.

List of American Patents which issued in February, 1844, with Remarks and Exemplifications. By CHARLES M. KELLER, *Examiner of Patents.*

1. For a *Washing Machine*; James B. Coffin, Big Prairie, Wayne county, Ohio, February 2.

This machine consists of two sets of horizontal rollers, each set being composed of four, or more, ranged one above the other, with their gudgeons working in grooves so inclined that the weight of the rollers causes those of each set to press, in opposite directions, against the clothes that are attached to a frame, and, with it, worked up and down between them.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the series of rollers placed in oblique grooves with the vibratory frame constructed and arranged substantially as described.”

2. For a *Wheat Fan for cleaning grain*; David Watkins, Port Republic, Rockingham county, Va., February 2.

This improvement is simply a long screen, which may be attached to the shoe of any wheat fan that can give to it a vibratory motion lengthwise.

Claim.—“What I claim as my invention, and wish to secure by letters patent, is the combination of a horizontal extended screen with the wheat fan, said screen to be operated and constructed as described.”

3. For an improvement in the mode of *Propelling Canal Boats*; Henry R. Worthington, New York City, N. York, Feb. 2.

This is claimed as an improvement on a mode of propelling canal boats, patented by Benjamin D. Beecher, on the 31st of December, 1839, and noticed at page 111, of the first volume, third series of this Journal, to which the reader is referred.

Instead of the two screw propellers employed at the bow, by Beecher, under the present patent, there are two paddle-wheels, one on each side of the bow, and either the shafts of these wheels are so inclined as to form a right angle with the general planes of the bow, or the shafts are at right angles to the keel, and the plane of the paddles so inclined as to strike the water at right angles to the general planes of the bow.

The object of this improvement is obviously to carry the current of water, generated by the paddles, in a direction that shall not impede the passage of the boat, instead of throwing it against the bow.

Claim.—“What I claim is the combining with a canal, or other, boat, having bows formed in the ordinary way, of two propelling

wheels constructed as herein described and represented, and in the manner made known; said wheels being located at, or near, the bows, and in advance of the greatest sectional width of the boat, their buckets also being so arranged that the plane of their surfaces, when vertical, and acting upon the water, shall be at right angles, or nearly so, with the general line of the vessel's bow, that they may displace, or divide, the water, and cause it to pass off from the bows of the boat in the direction designated, and for the purpose set forth."

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4. For an improvement in the *Roller-Gin, for ginning Cotton*; Richard Reynolds, jr., Beaufort, South Carolina, Feb. 2.

In this gin there are two fluted rollers of nearly the same size, and a large, smooth roller. The two small rollers are arranged one above the other, and in front of the large roller, the axis of the upper small roller being nearly on a level with the axis of the large roller. The bearings of the small under, and the large, roller work in sliding boxes provided with springs, by which they are both pressed against the small upper roller, so that the cotton passes in between the upper and lower small rollers, and then between the upper small roller and the large roller behind it. In the following claim, the upper small roller is designated by the letter *b*, the small roller below it by the letter *c*, and the large one by the letter *f*.

Claim.—"I do not claim, as my invention, the employment of these rollers together, as this has been done for burring wool, and for other purposes, but what I do claim as my invention, and desire to secure by letters patent, is the manner in which I have arranged the three rollers, *b*, *c*, and *f*, so that the cotton shall enter between the small rollers *b* and *c*, and then pass between the roller *b*, and large roller *f*, by having them so arranged that the rollers *c* and *f*, are pressed by the springs against the roller *b*, as described."

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5. For an improvement in the *Vibrating Steam Engine*; Ebenezer A. Lester, Boston, Mass., Feb. 7.

We have here a modification of the well known vibrating engine. It is suspended by trunnions, or gudgeons, at the upper end of the cylinder, and the piston rod passes out through the lower end of the cylinder, and extends from thence to the crank below. The upper cylinder head is of a semi-cylindrical form, and fits and vibrates in a corresponding cap attached to the frame, and in these are formed the various steam chambers and ways, so arranged, that by the vibrations of the cylinder the induction and eduction passages are opened and closed. The action of the engine can be reversed by means of a three way cock in the head of the cylinder.

Claim.—"What I claim as my invention, and for which I ask a patent, is the manner of arranging and combining the steam chambers and the channels, or steam-ways, in the top piece, and the upper cylinder head, the said top piece and cylinder head being fitted to each other by their concave and convex cylindric surfaces, so as to cause the said steam-ways, or channels, to operate by the vibration of the

suspended cylinder, substantially as herein set forth. And this I claim, whether the engine be constructed so as to operate without a three-way reverse plug cock, or valve, or if made, or constructed, to be capable of reversing its motion by means of such plug cock, or cocks, as described."

6. For an improvement in *Flasks for Moulding Hinges*; Thomas Loring, Gloucester township, New Jersey, Feb. 7.

The patentee says,—“The flasks that I use are of that kind which enables the moulder to form any required number of moulds, by the use of one single pair; said flasks being hinged together at their corners, so that when a mould has been formed, the flask can be removed therefrom, and used for the formation of another.”

“I connect the upper part, or cope, of the flask to the drag, or lower part, by means of an elastic spring hinge, or joint piece, which is so formed and combined with the two parts of the flask, that when these parts are closed upon each other, without any thing between them, they shall fit together and form a close joint, the two parts being adjusted by means of pins, or ears, and being held together by means of hooks, or clasps, in the usual manner, when they are made ready for receiving the molten metal. The said spring hinge will also enable the two halves of the flask to close correctly upon a metallic card, when it is placed between them, so as to be ready for the hands of the moulder, its elasticity being such as to admit the flasks to recede to the distance of an eighth of an inch, more, or less, from each other.”

Claim.—“What I claim as new, and desire to secure by letters patent is the connecting of the two parts of the flask together, by means of a spring hinge, formed and operating substantially as described, so that by its aid the flask may be closed, either with, or without, the piece of metal, called a card, between the two parts, as set forth.”

7. For a mode of *Hanging Sliding Doors*; Wm. T. Forsyth, Philadelphia, Pa., Feb. 12.

This is an improvement on double sliding doors, generally employed to form the communication between two parlors: instead of making them to run on an iron rail, as heretofore, they are suspended by means of rollers, or jaws, to a rail above, so that the lower part may not touch and drag on the floor.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the arrangement of suspension doors, &c., upon a suspension bar, by means of rollers and jaws, or clamps, or by any other analogous device, the whole being constructed and operating substantially as set forth.”

8. For an improvement in the *Rotary Steam Engine*; Abram Pease, Lyons, Wayne county, N. York, Feb. 12.

This patent is granted for an arrangement of parts to open and

close the valves of a rotary steam engine. The valves are provided with connecting rods, the outer ends of which are jointed to cranked arms, which cranked arms are jointed to two arms projecting from opposite sides of the shaft of the engine. That end of the cranked arms that is jointed to the connecting rods, is provided with two rollers that embrace a bent rim, or annulus; and, as the arms rotate with the shaft of the engine, the valves are opened and closed by the bend in the rim, or annulus.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the method herein set forth, of governing the connecting rods which operate the valves, viz., by attaching the said rods to the cranks, connected with the arms on the shaft in combination with the curved rim, the same being constructed and operating substantially as described.”

9. For an improvement in the *Cooking Stove*; James Young and Elmon Parker, Philadelphia, Penna., Feb. 12.

From the back of the stove two pipes rise, one near each end, and run into a horizontal cylinder placed above the stove, in the manner of the elevated oven well known to stove makers. Within this cylinder there is a concentric cylindrical boiler of a diameter so much less than the cylinder, as to leave a sufficient space for a flue which surrounds the whole. The draught passes up through either, or both, of these pipes into the space between the boiler and cylinder, and thence into a pipe at the top.

Claim.—“What we claim as our invention, and desire to secure by letters patent, is the combination of the boiler with the elevated and concentric flue, or smoke-pipe, constructed and arranged as described.”

10. For an improvement in the *Straw Cutter*; Wiltham Hovey, Worcester, Mass., Feb. 12.

“The nature of this invention,” says the patentee, “consists in forming a cylinder, around which a series of knives are set spirally, the said knives being radial, and so fastened to the cylinder as to be adjustable, by which means they can be made to cut against a cylinder, or roller, of wood, or other suitable substance, with the greatest precision, after they have been ground.

“I do not claim a cylinder of knives cutting against a solid surface, as that has been done before, but what I claim as my invention, and desire to secure by letters patent, is the cylinder having any number of arms around it, to which adjustable knives are affixed and arranged, as above described, in combination with the roller against which they cut, in the manner and for the purpose described.”

The manner of attaching the knives, referred to in the claim, is simply making as many arms on each end of the stock as there are knives, and fastening the knives to them by means of screws that pass through elongated slots in the knives to admit of adjustment.

11. For an improvement in *Cooking Stoves*; Jordon L. Mott, New York City, New York, February 12.—Ante-dated December 1st, 1843.

The patentee says,—“My improvement is applicable to cooking stoves of different kinds, as it may be applied wherever boilers, or other cooking utensils, are placed, or a boiler plate situated over the fire chamber by which they are to be heated. It consists in the employment of a lid, or cap, and of two jambs, which are made to open and close simultaneously, by their combination with each other; and which, when closed, form a compartment within which the cooking utensils are enclosed, excepting towards their fronts, thereby preventing the escape of steam, and other vapors into the room, and causing them to be conducted off; there being an opening, or escape flue, at the back of said compartment, leading into the stove pipe, or chimney.

“What I claim therein as new, and desire to secure by letters patent, is the so combining of a cap and jambs, situated in the manner, and employed for the purpose, herein set forth, as that they shall be made to open and close simultaneously, by the raising and lowering of the cap; the hinge joints and levers by which the same is effected, being constructed and arranged substantially as set forth; not intending, however, by this claim, to limit myself to the precise formation of the operating parts as represented, but to vary the same as I may think proper, whilst I attain the same end by equivalent means.”

12. For an improvement in the *Cooking Stove*; Simon Pettes, Schenectady, New York, Feb. 12.

In this stove the fire chamber is placed above the oven, and at the back of the stove there is a diving flue, which leads the draught down to the space between the bottom of the oven and the bottom plate of the stove, which space is divided into three flues, by means of two plates “extending about three-fourths the length of the stove—the ends next the front being wider apart than those next the diving flue, so as to make the flue gradually increase in width.” This arrangement divides the space into three flues, the middle one receiving the draught from the diving flue, and discharging it into the two side flues, from whence it passes into a rising flue back of the diving flue. The diverging position of these two plates not only makes the middle flue wider at the outlet end than where it is connected with the diving flue, but gives the same character to the two side flues also.

The patentee informs us that “flues thus enlarged as they approach the outlet, are found to draw better than those of a uniform width, or contracted as they recede from the fire chamber.”

Claim.—“What I claim as my invention, and which I desire to secure by letters patent, is combining a diving flue back of the oven, and the diverging plates, connected therewith, placed under the oven with the stove, as described, the whole constructed and operating as set forth.”

13. For an improvement in the *Corn Mill*; Geo. T. Walters, Nicholasville, Jesamine county, Ky., Feb. 12.

This is for an improvement in the mill for grinding corn with the cobs. In the eye of the mill there is a conductor to receive and deliver the ears of corn to be cut by a set of knives, one being attached to and moving around with the runner, and four others attached to the bed stone at equal distances apart, and placed tangentially to a circle of less diameter than the eye of the runner.

Claim.—“I wish it to be understood, that I do not claim stationary knives in the bed stone, as that has been done before, but what I do claim as my invention, and desire to secure by letters patent, is the movable, adjustable knives placed tangentially, in combination with the revolving knife, situated under the balance rind, and attached to the spindle, all constructed and arranged substantially in the manner and for the purpose described.”

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14. For an improvement in *Moulds for Casting Butt Hinges*; Benjamin F. Harley, and John W. Morris, Philadelphia, Pennsylvania, Feb. 12.

The patentees say,—“In the old mode of casting butt hinges, separate cores, or chills, were used, in order to form the sand mould of the knuckles of the joint of the hinge. Our invention is designed, principally, to dispense with the cores, or chills, which have heretofore rendered the casting of the half hinge very imperfect. By our method the mould, or drag, of the half hinge is formed at once, by a simple operation, directly from the pattern, and without any draft whatever, producing a mould in which a perfect half hinge may be cast. And this we accomplish by the use of a plate which has a vertical movement, and which is perforated with an aperture of a shape corresponding with that of the pattern of the half hinge, which pattern is placed in the said aperture, in a horizontal position, during the operation of filling the flask with sand.”

It is obvious that the sand being filled in, and rammed over the pattern, and on the top of this movable plate, the plate can then be lifted up from the pattern with the sand, or drag, which is thus sustained, and the edges prevented from breaking off by the friction against the sides of the pattern.

Claim.—“What we claim as our invention, and desire to secure by letters patent, is the method of forming the drag, or bottom, part of the mould directly from the pattern for casting, as before described, or by any other mode substantially the same; that is to say, by the use of the movable plate for lifting the mould from the stationary bed, or pattern, thus dispensing with separate cores, or chills.”

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15. For improvements in the *Stocking Loom for Knitting Stockings*, &c., Richard Walker and Jefferson McIntire, Portsmouth, Rockingham county, N. Hampshire, Feb. 12.

The patentees say,—“In the knitting loom which we have invented,

our first improvement consists in the substitution of horizontal sliding stitches for the falling jacks, or sinkers, heretofore employed, by which means the friction is diminished, and this part of the apparatus is simplified, and much less liable to get out of order than the falling jacks. Our second improvement consists in the manner in which we arrange and operate the needles, said needles being placed vertically, with their backs towards the front of the frame, and the depresser behind them, under the stitches; by which arrangement the work is elevated, and exposed to the eye of the operator at all times."

The second of these improvements is the necessary consequence of the first, for a change of position of the stitches requires a corresponding change in the position of the needles; and, although this change of position of the stitches and needles is considered the essential part of the improvements, the claim is limited to the method of moving the stitchers, which is effected by means of a bar, or regulator, which lies between two shoulders on the stitchers, and which, by its movement back and forth, gives them the required movement.

Claim.—"What we claim as new, and desire to secure by letters patent, is the manner in which we have arranged and combined the regulator, or bar, with the stitchers, so that said bar will, by its vibration, move said stitchers back and forth, by its action between the shoulders thereof, as described, the horizontal position of the stitches, and the manner of combining the bar with them, rendering it unnecessary to use springs, or any analogous device for retracting the stitchers."

16. For an improvement in *Conical Balance Valves for Steam Engines*; Thomas McDonough, Middletown, Middlesex county, Connecticut, Feb. 12.

The following is the description of this improvement, given in the specification, viz.,—"The nature of my invention consists in connecting the conical valve with the well known balance piston, by means of a hollow stem, so that the steam can pass through the hollow stem to act below the balance piston, and thus always have an equal pressure on the upper side of the valve, and lower side of the piston, and on the lower side of the valve, and upper side of the piston. The valve to be placed, as usual, in a chest, and the piston in a cylinder, either above, or below, the conical valve."

Claim.—"What I claim as my invention, and desire to secure by letters patent, as an improvement on the well known conical balance valve, is connecting the valve with the balance piston, by means of a hollow stem, as described."

17. For a machine for *Breaking Coal*; Joseph Battin, Philadelphia, Penna., Feb. 12.

We make the following extract from the specification of this patent, viz.,—"Improvement in the manner of combining and arranging the toothed rollers used in the machine for breaking coal, which rollers,

as combined and arranged by me, are described, as follows, in the specification attached to letters patent for a machine for the effecting simultaneously the breaking and screening of coal, granted to me under date of the 6th day of October, 1843. The breaking part of my machine consists of two rollers of cast-iron, the peripheries of which are provided with teeth, so placed as that in the revolution of the rollers the teeth of each of them shall stand opposite to the spaces formed by two contiguous teeth on the opposite roller. These rollers are geared together in order to cause them to preserve the same relative positions. In the above named letters patent, this manner of arranging and combining the toothed rollers was not made the subject of a claim, the said patent having been obtained for the combining of a roller breaking machine with a screen, for separating the coal into different sizes required; but as the breaking rollers, so formed, arranged and combined, are applicable to the ordinary cylinder breaking machine, when not used in combination with a screen, and as I have found, by continued experiment, that such rollers constitute a real improvement in any breaking machine, I have determined to secure to myself the benefit of such improvement in a distinct and separate patent therefor.

“Rollers for the breaking of stone, of ores, of coal, of corn, and of other substances, have been frequently constructed, and are well known. Some of these have been fluted, and others have been furnished with projecting teeth in their surfaces, but they have never, as I verily believe, been made to operate in the manner in which my improved rollers operate.”

Claim.—“What I claim as new, and desire to secure by letters patent, is the so forming and gearing of such rollers as that the teeth of one of them shall always be opposite to a space between the teeth in the other, whenever they are operating upon the article to be broken, the same being effected substantially in the manner set forth.”

18. For a mode of *Opening and Closing Bee-Hives, called the “Bee Preserver;”* Samuel Cope, and J. D. Cope, Damascoville, Columbiana county, Ohio, Feb. 12.

The hive is to be provided with a lifting gate, suspended by a rod to a crank, on the shaft of which there is a wheel with two stops on it, and a barrel with ratchet, cord, and weights, like a clock, by which it is worked. A stop lever, projecting from an arbor, bears against the stops of this wheel, and prevents it from turning, except when lifted up at stated periods, which is effected by an index wheel, connected with a time keeper, and so formed that the attendant may change the periods of opening and closing the gate. The stops on the wheel are arranged one opposite the crank, and the other on the same side with it, that the wheel may be stopped either when the gate is up, or down.

The claim is limited to the index-wheel, and the stop-wheel, in connexion with a common clock, or other time-keeping apparatus, combined with the gate, for the purpose described.

19. For a *Buckle, or Clamp, for holding, or confining, tugs, straps, braces, belts, &c.*; Julius W. Hatch, Fayetteville, town of Manlius, Onondago county, N. York, Feb. 20.

This buckle, or holdfast, consists of a metal case having a bottom and two sides, with an eccentric roller parallel with the bottom, and having its bearings in the sides. The straps, &c., to be fastened, are passed in between the bottom, when the eccentric roller is so turned as to make the space between it and the case greatest, and then it is turned to compress the straps, &c., between it and the bottom of the case. It must be obvious that after this the tension of the straps must increase the pressure with which the eccentric roller holds it.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the combination of the eccentric cylindrical roller with the buckle case, consisting of back, top, and side plates, the whole being constructed and operating in the manner described.”

20. For an improvement in the *Cooking Stove*; S. S. Jones, Philadelphia, Penna., Feb. 20.

There are two ovens in this stove, one above the other, with a plate between the two, to separate the space between them into two flues. The fire chamber is situated in front of the lower oven, with a diving flue between them. There are two dampers, one that commands the flue that leads from the fire chamber over the lower oven, and the other to close either the back, or top, flue of the upper oven. By the management of these two dampers, and the arrangement of flues surrounding the two ovens, we are told that the heat can be carried entirely around either, or both, ovens at pleasure.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the arrangement and combination of the flues and dampers, constructed in the manner and for the purpose set forth, so that both ovens shall be entirely surrounded with heat, if desired, without return flues.”

21. For a machine for *Digging Potatoes*; Archibald C. Ketchum, Schenectady, N. York, Feb. 20.

The forward part of this machine is a share, or scoop, with sides and a projecting rounded point, which runs in under ground to dig up the potatoes, which, with the loosened earth, are forced up the inclined surface of the scoop, and delivered on to an inclined endless chain, or belt, composed of iron rods, which passes around two drums, or rollers, that receive motion from a wheel at the side of the machine, the periphery of which is provided with pins to take in the ground, and insure its turning, as the machine is pulled forward by horses, &c.

Claim.—“What I claim as my invention, is the combination of the share, which serves to unearth the potatoes with an endless revolving belt, or chain, serving to screen and separate them from the soil.”

22. For a *Composition for Glazing Earthen-Ware*; Thomas and Ephraim Parker, Orangeville, Columbia county, Pa., Feb. 20.

"Take about 150 pounds of lead ore in its natural state, and grind the same, in a common mill, to the required degree of fineness. Then take of common loam about one-fourth, more, or less, of the quantity of the lead ore, and grind it separately, or with the ore; take also of manganese, brass, or copper, filings, in quantity about one-tenth that of the lead, and grind them separately, or with the lead ore, to give the composition the required color, which, in this case, will be black, or green; but if a blue color should be required, smalt should be substituted for either of the above coloring articles. To these add a sufficient quantity of water to give the composition its required degree of consistency, say about as thick as cream, into which the article to be glazed is dipped, or it may be applied in the usual manner. Should verdegris be used with the loam and lead ore to produce a green color, it will not be required to be ground with them, but may be added in its powdered state."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the before described composition for glazing earthen-ware."

23. For an improvement in the *Machine for Cutting Straw, Corn-stocks, &c.*; Hiram M. Smith, Richmond, Va., Feb. 20.

The knife, which is described as being curved nearly in the form of a sickle, is attached to an arm, or handle, projecting from a shaft, and a little below the knife, and projecting from the same shaft as the handle, is a plate of iron called a guard, but which, in fact, is a gauge, against which the material to be cut is pushed, to gauge the length to be cut off. The cutting and feeding is done by hand in this machine.

Claim.—"What I claim as my invention, is the combination of the guard with the curved knife and arm, constructed and operating for the purpose described."

24. For an improved manner of constructing *Coupling Bars, for Coupling Railroad Cars, Locomotives, &c.*; Wm. D. Chesnut, Wilmington, New Castle county, Del., Feb. 20.

"My coupling bar has a jaw at each end, which is kept closed by a spring, so as to embrace the coupling bolt, and said jaws are so arranged as that they may play freely to the distance required, by the curvature of the road, but that they shall open and free the coupling bar from the bolt, should one of the connected vehicles run off the track, or be, from any cause, made to deviate a greater distance from a right line than is due to the curvature of the road; whenever such deviation takes place, a pin, or some analogous device, is brought up against a check piece under the platform of the car, or, where a platform is not used, by a check piece, otherwise situated, near the coupling bolt, and the jaws being thereby opened, the coupling bar

will be liberated." The pin, which is above described as striking against the check piece, to liberate the coupling, is attached to the bar, and independent of the spring, so as to separate the bar from the spring, and thus open the coupling, or it may be attached to a lever jointed to the bar, so that when brought against the check piece the lever may turn and force open the spring jaw.

Claim.—"What I claim as new and my invention, is the so arranging of the bar, the spring, the pin, and the check piece, as that the jaw shall be opened when one of the cars deviates from the track; the respective parts being connected with each other, and operating substantially in the manner set forth."

25. For an improvement in the *Lever Power for Pressing*, &c.; Robert Sanderson, Athens, Ohio, Feb. 20.

A long lever, working on appropriate journals, provided with rails to receive a loaded car, which is drawn by means of cords and a windlass from end to end, as occasion may dictate, constitutes this improved lever power, by means of which presses are to be worked; the said lever being connected with the press in any known manner.

Claim.—"What I claim as my invention, is the combination of the loaded car and rails with the lever, causing it to operate as such for the purpose of pressing, the whole to be constructed and operated as described."

26. For an improvement in the *Cooking Stove and Baker*; Ashley Hotchkiss, Maryland, Otsego county, N. York, Feb. 20.

In this stove the oven is placed above the fire chamber, with a flue surrounding it. The draught passes in at the middle of the bottom flue, and is divided, half going each way up the side, and along the top flues, to the pipe in the middle of the top. The boiler holes are arranged on the top, and for the purpose of concentrating the heat under them, there are two long dampers in each of the end flues, so arranged that their upper ends can be made to approach each other, and thus render the flues narrower.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the arrangement of the dampers for concentrating the heat to the bottom of the cooking utensils, in the manner and for the purpose set forth."

27. For improvements in the *Horizontal Paddle-Wheel for Propelling Vessels*; Peter Lear, and Ephraim Buck, Boston, Mass., February 20.

This method of propelling consists of two rotating plates, arranged at the bottom of the vessel, one forward of the other, in the middle, and provided with hinged flaps, or paddles, kept close, or folded up even with the surface of the rotating plates, to which they are hinged, by the resistance of the water during a portion of their circuit, and thrown out by a cam, or inclined plane, during that portion of their circuit in which they are required to act on the water to propel the

vessel. The inner face of each paddle is provided with an arm and roller projecting sufficiently to enable the cam, without projecting below the plane of the wheel, to open the paddle. The cams that throw out the paddles are so arranged, that their positions can be shifted at pleasure, and thus throw them out in any position relative to the length of the vessel; and in this way propel the vessel forwards, backwards, sideways, or quartering.

Claim.—“We claim the combination of the flaps, or paddles, (hinged to the wheel as described,) with the arms and the inclined plane, or cam, of sufficient length to keep the flaps open during that portion of their circuit in which they act on the water to propel the vessel, the whole being constructed as set forth. We also claim the above described manner of arranging two sets of propellers upon a vessel; or with respect to the keel thereof, viz., the placing the one in advance of the other, and in a line, or range, with the keel—or in the direction of the keel instead of the usual method of placing one on each side of the keel, and directly opposite to each other—the afore-said arrangement effecting various important advantages in sailing and operating a vessel. We also claim arranging the frame, or plate, of the inclined plane, or cam, so that it may be movable, or made to turn on its axis horizontally, or, in other words, we claim changing the horizontal position of the inclined plane, or cam, the same being for the purpose of throwing different paddles of the series into action, and thereby imparting to the vessel, or steam-ship, a lateral, quartering, or other desirable movement, as set forth.”

28. For an improvement in *Combined Water-Wheels for Mills, &c.*; Emerson G. Covel, Glenn's Falls, Warren county, New York, February 20.

The improvement under consideration is a modification of the well known tub-wheel, and consists in having two wheels, one above the other, with the buckets inclined in opposite directions, so that the water after acting on the buckets of the upper wheel, falls and acts on the buckets of the under wheel.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is combining the (upper) section of the water-wheel having semi-reversa buckets, and contracted issues with the lower section, having concave, or cavetto, shaped buckets—the two sections being geared together by bevel gearing, and turning in contrary directions, in a cylindrical flume, by the reaction and percussion of the water confined in said flume, as set forth.”

The buckets of the upper section are so curved as to make the spaces between them at the bottom narrower than at the top, and this constitutes the issues referred to in the claim.

29. For an improvement in *Railroad Cars*, to prevent accidents from what are termed snake heads; Elisha Tolles, New York City, New York, Feb. 20.

This improvement consists in attaching fenders to the bottom of the

car, between, and back, and forward of the wheels, those at the back and front having their under surfaces inclined, and extending from near the tread of the wheels to within a short distance of the car frame. These fenders are a little thicker than the wheels, and their under surface concave, so that they may catch the "snake heads," or bent ends of the rails, and force them into their proper positions on the line of the rails, and thus enable the wheels to pass over them without danger.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application to railroad cars of concave bars attached to the bottom of each car for the preventing of accidents from snake-heads, and broken wheels, &c."

30. For improvements in machinery for *Laying Rope, and forming, or winding, the same into coils for transportation, or stowage*; Stephen and James A. Bazin, Canton, Norfolk county, Mass., February 28th.

The bobbins with the strands are placed in flyers that travel about a common centre, and rotate on their own axis. The strand from the bobbin passes over a guide, thence around a grooved wheel on a hollow shaft, through which the strand passes to the layer on the end of the main shaft. The hollow shaft has a pinion on it which gears into a cog-wheel on the layer shaft, and the diameters of the pinion and cog-wheel regulate the quantity of yarn to be given out by each revolution of the flyer. There are as many of these flyers as strands in the rope to be layed.

The rope from the layer passes over a drum which regulates its delivery, and from this it passes under and over two pulleys on the vertical shaft of a crane, and thence over a pulley on the end of the long arm, or boom of the crane, which delivers it on to a reel, and as the crane turns freely on journals on the ends of its vertical shaft, the end of the arm, or boom, which carries the rope, is free to move and follow the coils formed on a reel immediately under it.

Claim.—"Having thus set forth our invention, we shall claim the manner of regulating the drawing of the strands from the bobbins, viz., by means of the series of gear wheels, hollow shafts, grooved wheels and guides intervening between the layer and bobbins, the same being substantially as set forth. Also, the mechanism for guiding, or distributing, the rope upon the coiling reel, the same consisting of the reciprocating crane applied to, or used, in connexion with the reel, and constructed and operating substantially as described."

31. For an improvement in the machine for preparing *Hemp, and other fibrous materials, for Spinning*; William Montgomery, Boston, Mass. Feb. 28.

This is for an improvement on that part of the machine which combs the slivers, by means of "gill pins," on their passage to the rollers and spindle. The gill bars are formed into two endless chains,

as is well known to those acquainted with this branch of manufactures, and the improvement in question is to cause the teeth in leaving the fibres, as they pass around the drum to return, to continue vertical until after they leave the fibres, which is effected by means of a projecting stud on the end of each of the "gill-bars," which is guided by an inclined plane attached to the frame.

Claim.—"I claim the combination of a projecting stud on one end of each of the 'gill-bars,' with a stationary inclined plane, or other suitable bearing stop, attached to the inside of the frame work, which combination causes the 'gill-bars' to turn so much in their bearings in the chain belts, as to make the heckling pins leave the sliver vertically, and without breaking the fibres of the hemp, the whole being as set forth."

32. For a composition of matter for *Coloring Hair*; Augustus Grandjean, city of New York, N. York, Feb. 28.

This compound, which the inventor calls the "American Brick," from the circumstance, it is presumed, that pulverized brick is one of the ingredients, is composed of well slacked lime, pulverized, four parts, (by weight) oxychloride of bismuth eight parts, venetian red of commerce one part—these three to be well mixed—then add, gradually, eight parts fused yellow protoxide of lead, and then distilled water, which has been rendered slightly mucilaginous with gum arabic. After the gum water has been added, stir the paste carefully for several hours, and after remaining in a suitable vessel for several days, it is to be Americanized, by the addition of well pulverized brick. This compound is to be moulded to the desired shape, and applied to the luckless head.

Claim.—"I do claim as my invention, the above described composition of matter, which I call 'Grandjean's American Brick,' to be made in the manner, as herein described, with the substance and in the parts, or proportions, by weight, as described; but I do not mean to confine myself to the very exact amounts, or parts, by weight, as herein stated, for a small difference in the amount of one, or another, part, may not effect any material difference in the result produced."

And after this follows various precautions and directions, which could only be interesting to those who are passing into the "vale of years" with so much reluctance, that they still desire to retain some of the appearances of youth, and therefore, we deem it unnecessary to add any thing more.

33. For an improvement in the *Oil-Feeder*, and other articles of a like character; Joseph Benson, Boston, Mass., Feb. 28.

This is an article used in all machine and engine shops, with which the rubbing parts of machinery are oiled. As heretofore made, it consisted of a cylindrical vessel provided with a long conical tube projecting from the top; but it is generally covered with oil that runs down from the end of the tube, and spreads all over; and the improvement in question, consists in providing the oil vessel with a chamber

at the top, having an aperture at the top, of a diameter somewhat greater than the tube which passes through it, to catch the oil that runs down the tube from the discharge aperture, and also in providing this aperture with a tube extending downwards to within a short distance of the top of the oil vessel, so that when it is turned down to pour out oil the small quantity that may have accumulated in the chamber, will be prevented from running out. The top of the oil chamber is provided with two, or more, small apertures, through which the oil, caught by the chamber, descends into the oil vessel.

Claim.—“Having thus explained my invention, I shall claim my improvement in the chamber, which is applied to the reservoir of an oil vessel, or other article of like character, in order to prevent the oil, or fluid, which descends on the outside of the discharging tube from running down upon the exterior surface of the vessel; the same consisting in covering the top, or contracting the sides of the said chamber, where it opens around the discharge tube, and thereby making the upper part of the said chamber, so that when the oil vessel is turned over into a horizontal position, or thereabouts, the oil in the chamber will be retained by the sides and top, or curving sides, alone. And I also claim a conical, or other shaped, tube, in combination with such a chamber, the said tube extending within the chamber, and opening around the discharging tube of the oil reservoir, in the manner and for the purpose set forth; the said chamber having one, or more, holes, or orifices, connecting it with the reservoir; and the whole of the above being constructed and operating substantially as specified.”

34. For improvements in the *Smut Machine* for cleaning wheat, &c.; Jacob W. Brower, Mount Airy, Surry county, North Carolina, Feb. 28.

This is for improvements in that kind of smut machines which consist of beaters that rotate in a vertical cylinder; on the beaters, and attached to their shaft, is a runner furrowed somewhat like a mill-stone, and working against another disk somewhat similar to the bed-stone of a mill, but placed above it. The grain after passing between these, and being rubbed by them, is acted upon by the beaters, and from the beaters it is discharged into the upper one of two inclined spouts connected with a fan blower, the upper of these spouts being separated from the lower by a screen.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the runner having an upper disk which is furrowed on its upper face as described. I also claim the double spout fan, in combination with the above machine, as described.”

35. For a machine for *Digging Trenches and Laying Pipes*; Ezra Cornell, Ithaca, Tompkins county, N. Y., Feb. 28.

This machine has a cutter for making a trench in the earth of the desired depth and width, and in the back part it has a curved groove

through which a lead, or other, pipe passes from a reel above, and by which it is layed; there being a roller behind to cover the trench.

Claim.—“What I claim as my invention, and wish to secure by letters patent, is a furrow, or trench, cutter, in combination with a curved channel, or groove, of one, or more, divisions, (for laying one, or more, pipes at the same time,) as described; and these I claim in combination with the drum, as described, for the purpose of depositing pipe at any desired depth, the whole being constructed and operating as set forth.”

36. For an improvement in *Railroad Cars for turning Curves*; John H. Quail, Philadelphia, Penna., Feb. 28.

The wheels on opposite sides are not connected together by axles passing through, as usual, but each wheel has a separate and independent axle working in a separate frame, and the ends of two such frames, on opposite sides of the car, are jointed together by two cross pieces, so that they can form parallelograms of any desired angle. The two cross pieces are also jointed to the draught bar—this constitutes one truck, and the draught bars of two such trucks are also jointed together by a pin and slotted hole, so that by inclining one draught bar in one direction inclines the other in the opposite direction, and thus by means of their connexion with the jointed cross pieces of the trucks, the axles of all the wheels are thrown in the direction of the radii of the curve. The car frame is supported by means of springs on the frames of the wheels in such manner as to leave them free to turn.

Claim.—“I am aware that the trucks of railroad cars have been so arranged, that the axles of the wheels could be thrown in the direction of the radii of a curve by the draught, or guide, bar, the wheels on opposite sides being either attached to the same, or separate axles; therefore, I do not claim, as my invention, this general principle, but what I do claim as my invention, and desire to secure by letters patent, is the method of effecting this object by connecting the two sides, in which the wheels work, by means of the cross pieces jointed to them, and to the draught, or guide, bar, as described.”

37. For an improvement in the machine for *Cleaning all kinds of Cutlery*; William Vine, city of New York, N. York, Feb. 28.

This is for an improvement on a machine previously patented for this purpose, which consists of two disk brushes on a shaft, and facing each other. These are placed in a case provided with apertures, through which knives and other articles are passed in between the two brushes, which are turned by a crank handle, and supplied with any polishing powder.

The improvements secured by this patent, are substituting for the brushes, disks covered with strips of buff leather with the edges overlapping, and feeding in the polishing powder near the centre of the disks, instead of the periphery, as in the previous machine.

Claim.—“What I claim as my invention, is feeding, or supplying,

the polishing powder at, or near, the centre of the polishing surface, as described. I further claim covering the faces of the polishing wheels with strips of buff leather, cloth, or other similar material, the edges of which strips shall extend loosely over each other half their width, more or less, as described."

38. For an improvement in the *Rotary Inclined Propeller*, for vessels, &c.; Richard F. Loper, Philadelphia, Penna., Feb. 28.

This propeller has four wings, or paddles, forming a cross, and their planes are at, or near, an angle of forty-five degrees, and instead of having them project from a cylindrical hub, as heretofore, they are all connected together, or made in the solid, and then put on to a shaft, and the propelling surfaces extend entirely down, forming an angle at the junction of the several paddles, by which means the inventor claims that he can obtain a greater amount of propelling surface, within a given diameter, than can be obtained by having the paddles attached to and projecting from a cylindrical hub.

Claim.—"What I claim as my invention is the before mentioned manner of constructing the propellers, by extending their inclined planes, or propelling surfaces, into the hub, or centre portion, of the propeller, as set forth."

39. For an improvement in the *Churn for making Butter*; Geo. W. Cook, Schenectady, New York, Feb. 28.

This churn consists of a semi-cylindrical case hung on journals, for the purpose of rocking, and inside of this case there are two frames to which paddles are hinged, so that as the cream passes around them in rocking, they are alternately opened and closed.

Claim.—"What I claim as my invention, is the combining with a rocking churn, floats, or paddles, arranged in, and hinged to a frame, as described."

List of Patents granted for Designs, under the third section of the Act of August 29, 1842.

For a *Bust of Robert Burns*; John C. King, January 31, 1844.

For a design to be cast in metal to be applied as an *Ornament to surround Stoves*; Jordon L. Mott, New York City, New York, February 12, 1844.

We do not deem it necessary to insert the description, or claim, as these could not be understood without drawings.

List of American Patents which issued in the month of September, 1841, with Remarks and Exemplifications. By CHARLES M. KELLER, Examiner of Patents.

(Continued from Page 185.)

13. For an improvement in *Window Fastenings*; Enoch Robinson, and William Hall, Boston, Mass., Sept. 11.

To the lower rail of the upper sash there is jointed a turn button, with a hollow stem, in which is inserted a helical spring and sliding pin, or catch, which is forced, by the spring, towards the spindle on which the turn button works. The under part of this turn button is so formed as to permit the end of the sliding pin to pass out, and to catch in a notch on a hasp attached to the upper rail of the lower sash. The object of this improvement is to hold together and prevent the rattling of the window sashes occasioned by the shrinkage of the wood.

Claim.—“We claim as our invention constructing the fastening end of the lever, or turning button, of a horizontal hollow cylinder, closed at one end by a screw stopper, or otherwise, and arranging in said cylinder a spiral, or helical, spring and loose pin, the whole being constructed and operating together substantially in the manner, and for the purpose described.”

14. For an improvement in the *Water-Wheel for Mills*; Jesse Taylor, Aurelius, Cayuga county, New York, Sept. 11.

Claim.—“What I claim as my invention, and which I desire to secure by letters patent, is the before described construction of the water-wheel in combination with the trunk, collar, and shoot, for admitting the water through the centre of the bottom of the wheel to the interior thereof, and causing it to escape near the circumference through small apertures, which has the effect of turning the wheel in a contrary direction to that of the escape of the water; that is to say, combining with the trunk, collar, and shoot, as aforesaid, a hollow drum, or wheel, constructed with a circular rim, and a concave convex head, fixed to said rim, and to which head the shaft is fixed, and with a bottom which is also fastened to the said rim with a circular aperture in the centre of said bottom for the admission of water, and a series of small apertures near its periphery, in a circle concentric with the circle of the centre aperture for its discharge, the interior being hollow, with a rim made in segments, or less than the outer rim, arranged in a circle concentric with the outer rim, forming a space between the two rims in which are arranged inclined planes over the before mentioned small apertures, the approach to which are also inclined planes formed on the bottom over which vertical heads are fixed, between which and the last mentioned inclined planes, the water passes to the issues from the centre of the wheel through spaces in the inner segment rim, as described.”

We deem it unnecessary to add any descriptive remarks.

15. For improvements in the *Cooking Stove*; James Root, Cincinnati, Ohio, Sept. 11.

This stove is adapted to the burning of either wood, or coal. The fire chamber is provided with triangular grate-bars hung on pivots, and all connected together by means of a jointed bar, by which they can be shaken to discharge the ashes, or turned sufficiently to close the spaces between them, to exclude the air, for the purpose of retaining

fire. There is a large ash-pit below, and the hearth in front is a little lower than the bottom of the grate, the front plate being perforated to feed the fire with air through the hearth. "The boiler holes are arranged on the top, and there is a sliding damper used to open, or close, a direct passage from the upper flue to the escape pipe, when it is not desired to heat the oven. The under side of this sliding damper is elongated, so that when drawn out it shall project to such a distance into the upper flue, as to cause the draught of heated air from the fire to pass in the vicinity of the openings for the rear boilers, which it would not do without this provision."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of arranging and combining the respective parts constituting the fire chamber, the ash-pit, and the hearth; said arrangement and combination consisting of the fire chamber and ash-pit separated from each other by the grate bars, and each hung upon pivots, and connected with a handle by which they can be shaken, or closed, at pleasure; and of an independent hearth, not connected with any plate of the stove, except by the brackets used to attach it to the front plate, all as set forth. By which arrangement I am enabled to employ such a grate and ash pit as are herein described, which cannot be done where the hearth plate constitutes a part of that which supports the fire. I claim also the combining and arranging, in the manner set forth, with the boiler space and the oven, and the direct opening to the stove-pipe, a damper, so constructed and arranged, as that when drawn out it shall intercept the draught of heated air, and cause it to pass in the vicinity of the rear cooking utensils."

16. For an improvement in the *Grinding Mill*; Samuel Sheldon, Cincinnati, Ohio, Sept. 11.

This is for an improvement in the conical mill; to the bottom of the concave there is attached a spout to conduct the ground meal, or flour, to an appropriate recepticle. The spindle of the cone grinder, or nut, necessarily passes through this spout, and to prevent dust, meal, &c., from running down to the oil box at the lower end of the spindle, there is a tube attached to the spout, through which the spindle passes, the upper end of which runs in a groove made for its reception in the under side of the runner, or nut.

Claim.—"What I claim as my invention, is the manner in which I have arranged and combined the spout, the tube, and the nut, or cone, for the purpose of collecting the meal, or other article, that has been ground, and of preventing dust from passing into the oil box, as set forth."

17. For *Collapsible Vessels for containing Paint and other Fluids*; John Rand, a citizen of the United States now residing in England, Sept. 11.

The vessels heretofore employed for keeping paints, and used by

artists, are made of tin in a cylindrical form, with a small spout at one end, through which the paint is discharged by means of a piston at the other; but the improvement in question is for making these vessels of soft metal, such as grain tin, and after the vessel, or tube, has been filled with paint, the end of the tube is flattened and rolled up, or soldered; the other end being either flattened and soldered, or formed with a small neck provided with a screw cap. The paint is forced out by collapsing, with the hand, the end of the tube opposite the discharge aperture, and as the paint is discharged the back end is rolled up, the metal being sufficiently soft and thin to admit of this. When the neck is not used, the paint is discharged through a small hole made in one of the flattened ends, which can be closed again at any time by pressure.

Claim.—“What I claim is the mode herein explained, of preserving paint and other fluids in close vessels so formed as to allow of portions of such fluids being from time to time withdrawn, and the space previously occupied filled up by the collapsing of such vessels, (or parts thereof,) by slight pressure, and the openings closed from time to time, as described.”

18. For an improvement in the mode of *Binding and Confining Tobacco*; Albert Snead, Richmond, Va., Sept. 11.

Whilst tobacco boxes are under the press, it is necessary to bind them, to prevent the sides from being forced out, and for this purpose, under the present patent, it is proposed to form a rectangular frame with partitions, like a window sash, to divide the main frame into any desired number of spaces, each of the size required to receive a box. These frames are provided with bars and screws, or wedges, for the purpose of drawing them tight.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the application of the frame and partitions constructed and combined, as described, to binding up and confining tobacco boxes, while they are filled and pressed, during the process of manufacturing tobacco, by means of which a plurality of tobacco boxes may be filled and pressed, at one and the same time, under the screw, or other power press.”

19. For an improvement in the *Lamp for burning Volatile Oils*; Isaiah Jennings, New York city, N. York, Sept. 11.

Claim.—“What I claim as new, and desire to secure by letters patent, is the employment of two separate reservoirs for the supply of a lamp, or lamps, which reservoirs are to contain volatile ingredients of different natures, and which volatile ingredients are to be conducted into separate chambers in the burner, in which chambers they are to be evaporated, and their vapors are to be made to combine in a gas, or vapor, chamber, whence it is to escape through suitable holes, for the purpose of being ignited; the respective parts of the apparatus, for effecting this object, being arranged and combined substantially in the manner set forth.”

20. For an improvement in the machine for *Felting Fabrics made of Wool, Fur, &c.*; Henry A. Wells, New York city, New York, September 18.

This machine is for felting the fabric still more closely after it has been submitted to the operation of fulling. There is a metallic case, with the inner face convex, attached to the inside and near the bottom of a box. This case is divided, by a partition, into an upper and lower box, the concave portion of the upper one being perforated with small holes, and the ends of both provided with induction and eduction cocks, for admitting and letting out steam. The fabric is acted upon by a hammer, similar to that of a fulling mill, and hung to a pendulous arm, and in addition to this it is also acted upon by a presser, called a "top-piece," so jointed to the pendulous arm of the hammer as to cause both to act together, in compressing the fabric, at the same time that it is under the influence of dry and moist heat, by means of steam introduced in the two boxes; the steam which is introduced in the upper box being discharged on to the fabric through the small perforations in the convex face.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method described of subjecting the material, or bat, to the action of moist and dry heat, in combination with the method, above described, of applying pressure."

21. For an improvement in the machine for *Hardening Felt Fabrics*; Henry A. Wells, New York city, N. York, Sept. 18.

This machine consists of a hollow metallic bed, the upper face of which is pierced with small holes to permit the steam and dry heat together, or alternately, to pass through and on to the felt fabrics passing over, or lying on it. This hollow bed is provided with suitable cocks to admit the steam, and within it there are horizontal tubes connected together through which heated air, or steam, is passed for the purpose of applying "dry heat" to the fabric. The felt fabric passes over a roller at each end of the machine, and whilst it is under the influence of the "moist, or the dry, heat," or both, it is subjected to the action of a vibratory plate, or platten, to give the necessary friction.

Claim.—"What I claim is the method described of applying to the bat moist and dry heat, in combination with the method described of applying friction."

22. For an improvement in the *Lamp for burning lard, tallow, and other kinds of fat*; Moses S. Woodward, Marshalton, Chester county, Penna., Sept. 18.

The body of the lamp, which contains the lard, and which receives the burner, is so jointed to a stem, or stand, as to admit of being tilted to any desired extent. By this means the lard can be burned until it is nearly exhausted, for, by the tilting of the body of the lamp, the lard can be brought near to the ignited part of the wick. A metallic

conductor is employed in the usual way, and extends from near the flame to the bottom of the body of the lamp, for the purpose of keeping the lard, &c., in a fluid state.

Claim.—After disclaiming the use of a metallic conductor in a lamp, the patentee says,—“I claim the so constructing of a lamp for burning materials of the kind above named, as to combine with the said method of keeping the materials fluid, the means for tilting the body of the lamp in any required degree, for the purpose and substantially in the manner described.”

23. For an improved *Cooking Stove*; R. P. Putrick, Lockport, Niagara county, N. York, Sept. 18.

The patentee says,—“My stove consists of two principal parts, one of which contains the fire chamber, and two flat horizontal flues which extend therefrom, one of them from the upper, and the other from the lower, side of said fire chamber, said flues being so constructed as to be capable of sliding into flue spaces within the second principal part, in a manner to be presently described. The upper flue is furnished with boiler holes which may be used when the fire chamber is drawn out, or extended, but which are, at other times, embraced within a flue space in the second principal part. The second principal part consists of two ovens, one of them standing above the other, and having flue spaces at their rear sides, and above, below, and between them. The two flat horizontal flues of the fire chamber, slide in and out of the middle and bottom horizontal flue spaces of the second principal part, and when passed entirely within them the stove becomes a two oven stove; but when drawn out it then becomes a three oven stove, requiring nothing more than the applying of two doors, provided for the purpose, to complete the third oven.”

Claim.—“What I claim as new, is the combining the two principal parts thereof by causing the two flues to enter and slide within the two flue spaces in such manner as that when said flues are passed into the flue spaces to their whole depth, the stove shall contain two ovens only; and, that when drawn out to the proper extent, said flues shall constitute the upper and lower portions of a third oven, requiring only the application of two doors to render it complete; the respective parts being arranged, combined, and operating substantially as set forth.”

24. For an improvement in *Steering Boats*; Howard Nichols, New Bedford, Bristol county, Mass., Sept. 18.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the method of steering boats by passing the oar through a ring of metal, which is connected with the stern of the boat by a double joint, constructed substantially as described, by means of which the oar can be moved vertically and horizontally.”

25. For improvements in *Carriage Hubs and Axles*; Henry F. Phillips, Skaneateles, Onondago county, N. York, Sept. 18.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the employment of a tube, or thimble, of brass, or composition, on the arm of the axletree, so secured that the hub revolves upon it, while it is susceptible of being turned on the axle to shift the bearing part to some other portion of its circumference, as described. I am aware that the tube, or thimble, has been used on the arm of the axletree, but in such cases it has been permanently attached to the axle, and could not be shifted, &c.; therefore, I do not wish to be understood as making a claim to a thimble simply, but confine my claim, as above, to the employment of such a thimble when movable on the arm of the axletree. I also claim the method of retaining the hub on the arm by means of the screw box, in combination with the movable tube, or thimble, as described.”

26. For improvements on the *Combination, or Permutation, Lock*; J. B. Gray, Fredericksburg, Spottsylvania county, Va., Sept. 18.

This is, in the words of the patentee, “for improvements on the combination, or permutation, lock, which is opened and closed by the revolving of a series of rings that are connected together, so as to constitute a cylindrical body, and upon each of which there are numbers, or letters, by the arrangement of which, in a determined order, the opening is effected without the use of a key. Locks of this description are too well known to render a particular description of them necessary; and in my improvement upon them I have not made any changes in their internal structure, but I have so arranged the letters, or figures, and spaces upon the exterior of said lock as to increase the security against its being opened, without the necessity of rendering it more complex, by increasing the number of parts of which it consists.”

Claim.—“What I claim as new, and desire to secure by letters patent, is the dividing of the end plates of said lock on their peripheries, into a considerable number of equal parts, coinciding in size with the divisions on the revolving rings, either of which divisions, whether designated by letters, figures, or blank spaces, may be made the starting point in setting the revolving rings. And I likewise claim, in combination with the foregoing, the so constructing the revolving rings as that one portion of them shall require to be set by the spaces intermediate between the letters, figures, or other marks thereon, so as greatly to enhance the difficulty of opening the lock, from the manner of constructing substantially as set forth.”

27. For an improved mode of manufacturing *Figured Damask Hair Seating*; Samuel Ross, Camden, Gloucester county, New Jersey, September 18.

“The nature of my invention,” says the patentee, “consists in the introduction of an extra warp of silk, linen, cotton, or woollen, in ad-

dition to the one in general use in the manufacture of figured damask hair seating.

"I claim the invention of producing a satin, or twilled, ground work, at the same time I produce a full satin, or twilled, figure of any color, by the extra warp, which, when combined, produces a full satin, or twilled, face on the fabric."

To be Continued.

ENGLISH PATENTS.

Specification of a Patent granted to JULIUS ADOLPH DETMOLD, of London, for certain improvements in the construction and arrangement of Furnaces, or Fire Places, applicable to various useful purposes.—Patent dated Oct. 18, 1843; Specification enrolled April 18, 1844.

The principal benefits anticipated from these improvements are, 1. A more intense temperature than is produced in reverberatory furnaces of the ordinary construction; 2. An important saving of fuel; 3. A better yield in the working of metals—or, in other words, a diminished loss of metal from oxidation.

1. Mr. Detmold proposes to make the fire-grate of his furnace much deeper than those in furnaces now in general use, so as to have always a very thick stratum of fuel upon the grate, thereby preventing the passage of any undecomposed air through the grate into the furnace. In ordinary furnaces, the depth of the grate—that is, the distance between the grate-bars and the top of the fire-bridge—is generally from twelve to eighteen inches, and rarely as much as two feet; but in Mr. Detmold's furnaces the depth of the grate is from three to five feet, according as the coal used is more or less bituminous. When a caking, or highly bituminous coal, is to be employed, he makes the grate not less than three feet in depth; for the use of free burning coal, four feet; and for stone-coal, or anthracite, he finds a depth of five feet most advantageous.

2. Instead of relying upon the draught of a high chimney for the combustion of the fuel, he forces the requisite supply of air by means of any ordinary blowing machine, under the grate into the ash-pit, which is closed by an air-tight door. The blast, he says, will cause the imperfect combustion of the "lower stratum of coal immediately upon the grate, and the greater portion of the gases resulting from this will be a combustible gas, namely, the *carbonic oxide gas*, which is invariably produced when the proportion of carbon is in excess to that of oxygen; the portion of *carbonic acid gas*, which is produced, will, in its passage upwards, through the superincumbent mass of ignited coal, absorb an additional dose of carbon, and will, thereby, also become converted into *carbonic oxide gas*; at the same time the carbonaceous gases contained in the fuel, such as carburetted and bicarburetted hydrogen, will be evolved, or distilled, from the coal by the heat; and thus all the fuel in the fire chamber is converted into

combustible gases, which will pass over the fire bridge into the furnace."

3. The combustion of these gases is effected by forcing amidst them, in their passage over the fire bridge, heated and compressed atmospheric air, supplied in numerous small streams, "thereby causing a rapid and intimate combination of the oxygen of the air with the combustible gases, and, consequently, their immediate and perfect combustion, and a most intense temperature in that part of the furnace where it is required."

The body of fuel in the fire chamber, with the exception of the stratum resting immediately upon the grate, is never at a high temperature, as is the case in ordinary furnaces, but is kept at a low red heat, which is supposed to be quite sufficient to effect the transformation of all the fuel into combustible gases. The supply of blast (cold) under the grate, by which the combustible gases are generated from the fuel, and the supply of hot air for their subsequent combustion is regulated by means of cocks, or valves, which are directed to be so adjusted to each other as to effect the complete combustion of the gases, without having an excess of air in the furnace." "Thus, the effects of the flame in the furnace may be made at will, either reducing, neutralizing, oxidizing, according to the quantity of combustible gases generated, or the volume of hot air admitted for their combustion. The heat thus produced is more directly applied to the purposes required than in ordinary furnaces, in which the heat is produced by the imperfect combustion of the solid fuel in the grate, and where the metal under operation derives its temperature merely from the flame, in its passage through the main, or working, chamber of the furnace; whereas, in my improved furnace, the temperature in the fire chamber, where the combustible gases are generated, is quite low—but their actual combustion, and the intense temperature resulting therefrom, is concentrated in the very spot where the metals are placed for operation, and where the greatest heat is required. The loss of fuel, by the escape of unconsumed combustible gases out of the chimney, is thus avoided; and, as the combustion of the gases in the furnace is effected under a pressure greater than that of the atmosphere without, the loss of metal, by oxidation, in consequence of the air entering into the furnace, through the working door, or through any openings, or crevices, in the furnace, is entirely prevented." Mr. Detmold states, that "any kind of coal may be advantageously used in furnaces of this description; but that they will be found particularly applicable to the use of stone-coal, or anthracite, which has hitherto not been successfully employed for metallurgic purposes in reverberatory furnaces. He adds, that furnaces of this improved construction may be employed with great advantage in the working of all kinds of metals, and that he has himself used them with complete success, for "refining, puddling, and reheating bar-iron, as also for the forging of heavy pieces, such as steamboat shafts."

A furnace constructed on these principles, for refining iron, is represented in the following figures:—

Fig. 1, is a horizontal section, showing the plan of the furnace; fig. 2,

a vertical longitudinal section; and fig. 3, a transverse vertical section, showing the air-heating pipes in the stack.

Fig. 1.

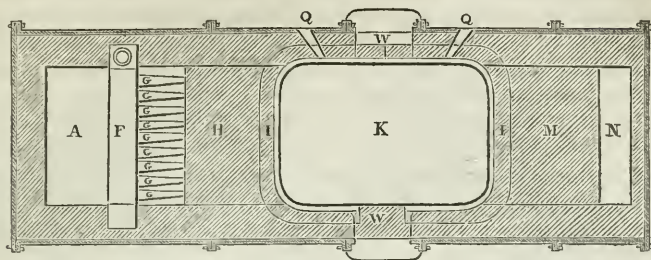


Fig. 2.

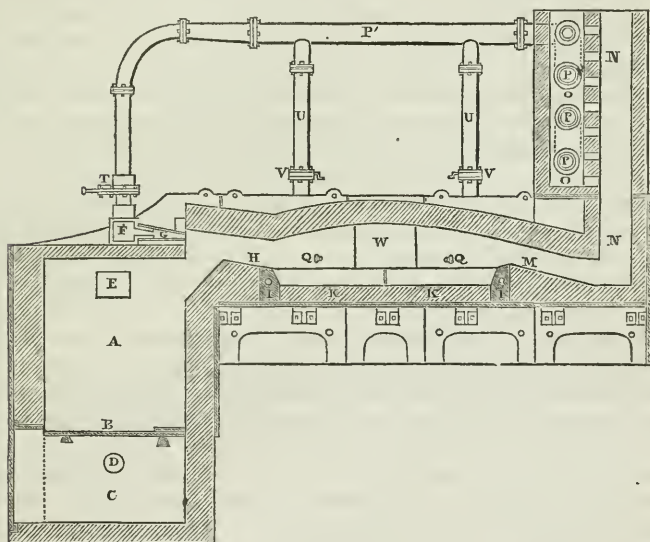
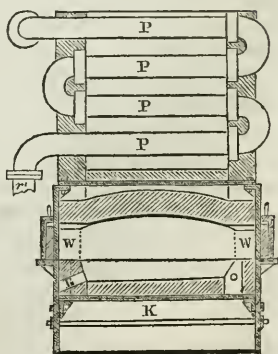


Fig. 4.



A, is the fire chamber, in which the fuel is converted into combustible gases.

B, is the grate, upon which the fuel is supported.

C, is the ash-pit, which is closed in front by an iron door.

D, is an opening in one of the sides of the ash-pit, through which atmospheric air is blown into it.

E, is the stoking hole, for filling the fire chamber with fuel.

F, is the hot air chamber, which is placed on top of the fire, or gas generating, chamber, and from which issue a row of blow-

pipes, G, through which the hot air is blown amidst the combustible gases in their passage over the fire bridge. The hot air chamber, F, is of cast-iron, and the blowpipes are of sheet-iron; they are made about fifteen inches long, two inches diameter at the larger end, and one inch and a quarter at the mouth, which should be slightly flattened. In this instance, there are nine blowpipes used; but a greater or less number may be employed.

H, is the fire bridge, over which the combustible gases and the streams of hot air become mingled; it is made much longer than in ordinary furnaces, being two feet six inches from the end of the blowpipes, for the purpose of affording the gas and air time to become thoroughly combined before entering the main chamber of the furnace.

I I, are cast-iron blocks that surround the entire hearth of the furnace, and through which a stream of cold water is made to circulate, for the purpose of protecting the sides from the intense heat, and the destructive effects of the melted iron and scoria.

K K, is the hearth, which may be made of fire bricks set very close on edge, or of good fire sand. It is made to slope towards the tap hole, L, so as to enable the refined iron to run out more easily.

M, is the throat, or flue, of the furnace.

N, is the stack, or chimney.

O, is a chamber, in which is placed a system of pipes for heating the air. This chamber is separated from the stack by a partition of brickwork, which has, however, numerous openings, through which sufficient heat is communicated to the pipes, P P P P, to heat the air which is forced through them to the required temperature. This may be regulated with great nicety, by allowing more or less of the burnt gases to pass into the chamber O, through the openings in the partition, by contracting either the chimney N, or the chamber O, at the top.

Q Q, are tuyeres, through which streams of hot air are blown upon the melted iron, for the purpose of refining and decarbonizing it. They are so placed that their axes converge towards the middle of the hearth, and have a pitch of from 25° to 30° , which will cause the liquid iron to move round in two opposite currents, thereby exposing every part of the surface of the metal to the decarbonizing action of the hot blast.

R, is a pipe leading from the blowing machine that supplies the cold blast, and from which a branch, r, goes off, to furnish the blast under the grate into the ash-pit, and which is regulated by the valve S. Another branch, r', rises, and communicates with the pipes, P, in the chamber O, whence the heated air is conveyed by the pipe P', to the hot air chamber F, where its supply is regulated by the valve T.

U U, are two small branch pipes, descending from the pipe P', which convey the hot blast to the tuyeres Q Q, which is regulated by the valves V V.

W W, are the working doors of the furnace, there being one on each side of the furnace.

The mode of refining iron in a furnace of this kind is as follows:—

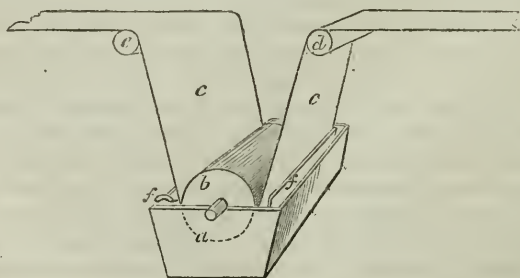
The fire chamber A, is filled with fuel, and after it is ignited the cold blast is let on under the grate, by which the combustible gases are generated; the valve T, is then gradually opened to admit the hot air for the combustion of the gases. After the furnace has been brought to a white heat, from 25 cwt. to 30 cwt. of pig-iron is charged, and spread all over the hearth, piling it in such manner that the flame may circulate well through. When the charge is melted down quite thin, which will generally be the case in one hour and three-quarters, the hot blast is let on through the tuyeres Q Q, by which the iron will become refined. In about one hour to one hour and a quarter, the metal will be found sufficiently refined, when the furnace is tapped, and the metal runs into the mould.

This mode of refining is stated to afford a very important saving of iron over the ordinary method, in the open finery fire. "In the latter, the iron is exposed to the oxidizing action of the blast from the tuyeres, during the whole period of its melting down, so that a very large proportion of the iron is actually converted into cinder before the whole charge is fused. The loss of iron in the open finery varies from 12 and 15 per cent.; but in the operation of refining, in my improved furnace, the whole charge of iron is melted down without any loss from oxidation, as no more air is allowed to enter the furnace than what is required for the combustion of the gases—and the process of decarbonization does not commence until after all the iron is fused; the loss of iron in my furnace is, therefore, much reduced, and rarely exceeds seven per cent., but varying, generally, from five to seven per cent."

Furnaces of this description may, it is said, be also employed with great advantage for the puddling of crude, or pig-iron, by combining the two processes of refining and puddling in the same furnace. "When employed for this purpose, the hearth should be made about eighteen inches wider than that of the refinery furnace just described, which it resembles in all respects except the bottom, which is the same as in ordinary puddling furnaces. The charge is double, being about nine cwt.; and, as the furnace has two working doors opposite to each other, two puddlers work at it at the same time. After the charge is melted down, it is subjected to the streams of hot air from the tuyeres, in the same way as in the refining process; but, instead, of tapping the metal when it is sufficiently refined, the blast from the tuyeres is shut off, and the quantity of gas to be generated is slightly diminished, whereby the temperature of the furnace is reduced to a proper puddling heat. The puddlers then commence to work the iron, the same as in the ordinary furnace, regulating the temperature at will, by generating more or less gas, as may be required. The reheating and mill furnaces, or such as are intended for the forging of heavy pieces, are the same in their arrangement of parts as the refining, or puddling, furnaces just described, varying only in the shape and dimensions of the hearth, according to the nature of the work for which they are intended."

Specification of a Patent granted JULIUS SCHOTTLÄNDER, of the city of London, for certain improvements in the deposition of Metals upon various Felted and other Fabrics —Granted December 8, 1843; Enrolled June 7, 1844.

The mode of effecting the deposition of metals upon felted and woven fabrics, is as follows:—A plate of copper is, in the first place, to be provided of the required dimensions, one side of which is to be covered with plumbago, and the other rendered inactive by covering it with varnish, or other suitable material, the piece of cloth, or linen, fabric, to be metalized is then to be stretched tightly over that face of the copper-plate which has received the plumbago, and secured by its edges in any convenient manner. The copper plate and piece of fabric to be metalized, are then to be immersed in a solution of sulphate of copper, and the plate connected with the zinc end of the battery; another copper-plate is then to be immersed in the solution, and connected with the copper end of the battery, when the action of the battery will commence, and the metal will be deposited upon the copper-plate between such plate, and the fabric to be coated, and by continuing the operation the metal will begin to penetrate the pores of the cloth, and will appear on the opposite, or back, side of the cloth in small globules. When the operation has been continued a sufficient length of time, the metal plate and cloth may be taken out of the solution, and the metalized cloth removed from the copper-plate, which will be very easily done, and should the plate employed have a smooth surface, the face of the metalized cloth will have a polished surface, but should the copper-plate have an engraved, or embossed, surface, the metalized cloth will also have an embossed surface, and be a fac-simile of such surface, the copper-plate forming the die, or matrix. Ornamental designs may also be produced by drawing upon the copper-plate with some non-conducting substances; or portions of the plate may be cut away; by these means various ornamental designs may be produced, which may be afterwards silvered, gilt, or otherwise finished.



When it is required to metalize a piece of cloth of considerable length, the inventor employs an apparatus consisting of a vessel *a*,

within which is put the sulphate of copper, or other solution; *b*, is a copper roller supported by the ends of the vessel; *a c*, is the piece of cloth to be metalized, and which piece passes over the roller *d*, down and under the copper roller, and up over the roller *e*; *f*, is a copper-plate connected with the copper-pole of a galvanic battery, the copper roller *b*, being connected with the zinc pole of the battery, the parts of the apparatus being connected to the battery by copper wires, and the vessel *a*, filled with the solution of copper, a slow motion being imparted to the roller *b*, the deposition of metal takes place between the cloth and the roller in the manner above described, and should the roller be engraved with some ornamental design, a fac-simile will be obtained. It will be found of great advantage previously to operating upon woven, or felted, fabrics, to wash over the surface of the cloth with clay and water mixed to about the consistency of cream, and then allow it to dry, after which the cloth may be washed with water, which will leave some of the finer particles of clay in the cloth, and will thereby render it more porous and better adapted, in other respects, for the purpose described.

When the surface to be metalized consists of glass, or glazed earthenware, the surface is to be roughened by mechanical, or other means, such as grinding. The parts to be deposited upon are then to be surrounded by a matrix of metal, which is to be connected with the zinc end of the battery, its inner surface being made conducting by means of plumbago. The article to be deposited upon is then to be immersed in the solution, and also a copper-plate, which latter is to be connected with the copper pole of the battery; the metal contained in the solution will then begin to fill up the parts between the matrix and the article to be deposited upon, and by these means any design may be copied and firmly fixed upon the glass, or glazed surface of earthenware.

Civ. Eng. & Arch. Journ.

MECHANICS, PHYSICS, AND CHEMISTRY.

Extracts from the Report of Capt. G. W. HUGHES, of the Topographical Engineers, to the Secretary of War, relative to the working of Copper Ore.

(Continued from page 202.)

On the Cornish Engines.—The pumping engines used for draining the mines of Cornwall,* have lately excited much interest in the scientific world, from the circumstance of their performing with a given quantity of fuel, nearly three times as much work, or, as it is technically termed, *duty*, as any other engines have yet been made to accomplish; and, therefore, a slight notice of them, and of the history of their improvement, may not prove uninteresting.

* Engines have been very recently constructed on the same principles for the drainings of the Lake of Hørlem, with cylinders of 12 feet diameter.

The common Bolton and Watt single acting engine, used for pumping water, which was formerly applied to these mines by Watt himself, is so well known, and has been so often described, that it will be sufficient merely to point out the differences which exist between this and the Cornish engine, in its present most improved state.

The first and most important is, that the steam is used at a high pressure—say from thirty to forty-five pounds per square inch above the atmosphere—in the boilers; is cut off at a small portion of the stroke, and allowed to expand during the remainder. The principle of expansion was introduced and patented by Watt, but was used by him only to a very small extent, and with low pressure steam. It is now carried much further, and the steam is generally expanded from four to eight, or ten, times its original volume, and, in some of the more recently constructed engines, much more. The new engine at the United Mines, which was kindly shown and explained to Mr. Pole and myself by Messrs. Hocking and Loam, the engineers, has been sometimes working with the steam cut off at one-twelfth, or one-fifteenth, of the stroke; and Mr. Sims, another engineer of celebrity in the county, has lately taken a patent for a mode of increasing still further, the power of using the steam expansively. This forms, indeed, the great feature of the Cornish engines, and is, without doubt, the principal cause of the extraordinary amount of duty performed by them.

The use of high pressure steam has necessarily induced a change in the form of *boiler*, from that originally adopted by Watt. The boilers now used are cylindrical, with an internal tube of large diameter running through them, in the front part of which is placed the furnace. The *slow* combustion principle is carried to a greater extent in Cornwall than elsewhere, and it is the generally received opinion there, that much advantage arises from the practice. Doubts have, however, been lately thrown upon the correctness of this idea, by the publication of some experiments made within these last few years at the London water-works, of which I shall more particularly speak hereafter.

The care which is taken to economize heat, and prevent waste of fuel is exceedingly great. The tops of the boilers are covered with a bed of ashes about two feet in depth; the cylinder is inclosed in a steam jacket, and this again is surrounded by a wooden case, having a considerable thickness of saw-dust between it and the hot metal. The steam pipes are encased in like manner, so that the radiation of heat is almost entirely prevented, and, in consequence, the engine and boiler houses are little, if any, warmer than common rooms. The condensed water from the steam jacket is also returned to the boilers; the steam is prevented from ever blowing off at the safety valve, by careful management of the fires; and, in short, every precaution that ingenuity can devise, or prudence suggest, is taken, in order to reduce to its lowest possible limit the dispersion of heat, and consequent waste of fuel.

The arrangement of the pumps and their machinery has been greatly improved since the days of Watt, and no inconsiderable share

of the improvements in *duty*, is attributable to this cause. The description of pumps universally employed now, (except in the lowest part of the well, where a lift pump is placed,) is the *plunger pump*; three or four of these, according to the depth, being placed at different levels in the shaft.* The rods which connect the plungers with the outer end of the engine beam are necessarily, from their length, of great weight; and it is this weight, or, at least, a portion of it, which causes the plungers to descend, thereby forcing up the water in the ascension pipes. The mass of rods is raised by the action of the steam in the descent of the piston; and when this has arrived at the bottom of its course, and by the opening of a valve, the equilibrium is restored between the upper and lower parts of the cylinder, the rods again raise the water by descending, and are afterwards again raised by the steam in their turn, so that the power of the steam is not immediately employed to raise the water, but lifts a dead weight, which, in its descent, forces down the plungers. The pump rods generally furnish more weight than is sufficient to overcome the pressure of the column of water in the ascension pipes, and the surplus is counterbalanced by weights attached to levers, or "balance bobs," placed at the surface, or in horizontal excavations in the shaft. There are many minor improvements which have been made in the valves, and other details of the engine, as well as in the method of managing and working it; all of which have conduced more or less to the advancement of the duty performed, but which our limits will not permit me to describe. They do not, indeed, affect the general principles upon which the engine works; and enough has been said to show that this, by far the most perfect and effective form of an invention, itself the most perfect and useful to mankind of any yet recorded in the page of history—that this is, to all intents and purposes, WATT'S ENGINE; and that it has only been by carrying out, to a further extent, the principles laid down and first put in practice by that great man, that the extraordinary achievements now witnessed have been accomplished. And, in fact, one of the most eminent of the Cornish mining engineers has said, in speaking of the modern pumping engines, that "the engine is now reduced to its simplest form, a single engine on Bolton & Watt's construction; and, although our engines exceed in duty three or four fold what Bolton & Watt had ever attained, or perhaps thought possible of attainment, yet they are, after all, in name and reality, Bolton & Watt's engines." It would be, however, an act of gross injustice to the Cornish engineers to pass by unnoticed the improvements in the performance of the steam engine, due to their mechanical skill, and scientific knowledge; and, indeed, if their merit be measured by the advantages which have resulted from their efforts, they, as a body, will deserve most memorable mention in the annals of the steam engine.

I shall now proceed to present a brief view of the history of the various improvements in duty which have gradually taken place for the last half century, the materials for this purpose being supplied by a very succinct account compiled by the Messrs. Lean, brothers, and

* All these fittings, including the "balance bobs," constitute what is called the "pit-work."

published by direction of the British Association for the Advancement of Science. To this work I refer for more detailed information.

It will be as well to explain that the word "*duty*" may be defined to mean the useful effect produced by the engine, considered in proportion to the quantity of fuel consumed. In Cornwall, the *duty* is always stated in *pounds lifted one foot high* by the consumption of one bushel (about 94 pounds) of coal. Thus, when it is said that a certain engine performs a duty of seventy millions, it is understood to mean that the engine lifts seventy millions of pounds of water one foot high for each bushel of coal consumed.

The connexion of WATT with the Cornish miners, who paid him for his great improvements by a per centage upon the value of the fuel saved by them, is well known, and is mentioned in almost every history of the steam engine. It may be sufficient to state here that he raised the duty from about nine millions, as previously performed by the atmospheric engine improved by Smeaton, to upwards of twenty millions; and the average duty in eighteen hundred, when the patent of Messrs. Bolton & Watt expired, and their agent left the country, may be stated at this amount. After this period a great and general deterioration took place, from the want of persons of sufficient experience and scientific acquirements to keep the engines in the same good state, and to work them to the same advantage, as formerly.

This state of things lasted for many years, until, in 1810, or 1811, the practice of publishing monthly reports of the duty of all the engines in the country was commenced by Capt. John Lean, and has continued uninterruptedly to the present time. This publication produced a very extraordinary effect in improving the duty of the engines. The public attention being drawn to the amount performed by each, stimulated the engineers to emulation among themselves, so that many engines, before much inferior, began to improve in duty when the results were published to the world; and the practice is said, by Messrs. Lean, to have been attended with more benefit to the country than any other single event, with the exception of the invention of the steam engine itself. Its effects were soon manifest, for, in 1814, one engine performed thirty-two millions, and the average of the county was raised again to where Watt left it—namely, twenty millions.

In the latter part of 1814, Woolf demonstrated the possibility of increasing the duty by using high pressure steam, and expanding it more than hitherto practiced, which he did by his double cylinder engine. One of these, erected at Wheal Vor, in 1815, performed fifty millions. It was not long, however, before it was discovered that this principle of using high pressure steam expansively might be used equally well with a single cylinder; and, after 1820, the more cumbersome and expensive form of Woolf was very little used in the mines. In 1821, the average duty was twenty-eight millions, and that of the best engine forty-two.

Shortly after this period, Capt. Samuel Grose introduced various improvements at Wheal Towan, and performed sixty-two millions. The principles adopted by him were followed, with modifications, by

other engineers, and their advantage was rendered obvious by an immediate advance in duty of the whole.

In 1834, a very important occurrence took place; Mr. Wm. West, who had formerly filled a situation under Capt. Grose, constructed an engine at Fowey Consols mine, which, in September of that year, was reported at a duty of 97,856,382. Such an extraordinary and unprecedented amount created great astonishment among the engineers of other mines. Suspicions were entertained that some deception must have been practiced, and Mr. Austen, the proprietor of the mine, was called upon to verify, or disprove, the statement, by allowing a trial to be made of the engine before competent and impartial persons. He responded to the call; and seven gentlemen were named by J. S. Enys, Esq., of Enys, for the purpose. They made a most accurate experiment of twenty-four hours' duration, and reported the duty performed to be equal to 125,095,713 pounds lifted one foot high by the consumption of a single bushel of coal! This is, I believe, the highest amount of duty which has ever been obtained. Up to the present time, the general average has been steadily improving, and many engines are now working at ninety millions and upwards. The one at the United mines, lately erected by Messrs. Hocking & Loan, was reported, in the month of July, 1841, at 101,500,000. It is one of the largest in the country.*

When it is considered that the useful effect of the best land, or marine, engines now made, when reduced to the same standard as that used for the Cornish engines, gives a result rarely exceeding thirty millions, it need not be wondered at, that the engines in that country must have excited great interest among engineers throughout the world. But although for such a length of time these improvements have been going on in the manner above described, it is only very lately that the general attention of men of science in other localities has been drawn to the very extraordinary results produced by them; and when the reports were first brought forward in London, they were almost unanimously treated as fabulous—many of the most eminent scientific engineers expressing the opinion, and, in some instances, sustaining their opinions by calculations, that it was absolutely impossible that steam could be made to perform feats so wonderful, and so much surpassing what had before been experienced. As, however, the statements and guarantees of their correctness be-

* The following are the principal dimensions and other particulars of the new engine at the "United Mines," called "Taylor's Engine:"—

Cylinder, 85 inches diameter.

Length of stroke of piston, 11 feet.

Length of stroke of pumps, 10 feet

Diameter of principal working plungers, 14 inches.

Depth of shaft, about 173 fathoms.

Number of strokes per minute, about $4\frac{1}{2}$.

Water lifted, about 60 gallons per minute.

Weight of main beam, 27 tons.

Cylindrical boilers, each about 25 feet long, and 6 feet 6 inches in diameter.

Cost of engine, £2,500.

Cost of pumps, &c., £5,000.

Cost of shaft sinking, £8,000.

came stronger and more numerous, scientific men began to look more closely into the matter. Some eminent engineers went down to Cornwall, from London, purposely to convince themselves of the truth, or falsehood, of the reports. The most searching experiments were tried—the water was, in some instances, even weighed as it came out of the pumps; but nothing was found to cast the shadow of a doubt upon the correctness of the reports; and now the evidence has become sufficiently strong to command universal assent.

But more than the evidence of witnesses at a distance has been obtained, for, in order to put beyond a doubt the truth of the assertions as to the amount of duty performed, one of the Cornish engines has, so to speak, been actually transplanted to London, and tried there; and a most interesting record of experiments upon it has been recently published by Mr. Wicksteed, the engineer of the works where it has been erected and used for supplying water to the metropolis. The following extract will explain the circumstances under which it was introduced:—"In the spring of 1835, the directors of the East London Water-Works Company, contemplated making very considerable alterations in one of their engines at Old Ford; and it was then suggested by Mr. Grout, one of the directors, that instead of altering the engine in question, it should be taken down, and a Cornish engine erected in its place; and he stated that the saving in fuel, that would be effected by adopting his suggestion, would amply repay the company for the increased outlay consequent upon the erection of a new engine.

"I am told that but little reliance was placed upon the accuracy of this information; my opinion was, however, called for, when I stated, that although I had never seen a Cornish engine at work, I understood the principle of its action, which my friend, Mr. John Taylor, had explained to me as far back as 1826; and I was also aware of the favorable views entertained by the late Mr. Watt, of the advantages to be derived from using steam expansively, and had, therefore, no doubt that the effect produced by the Cornish expansion engines was much greater than that produced by the non-expansion engines.

"In August, 1835, I was instructed to visit several of the mines in Cornwall, for the purpose of obtaining information respecting the engines in use there; and although my report was highly in favor of them, the opinions expressed in favor of the *old* system, and against the *new*, advocated by me, were nevertheless so numerous, and of such high authority, that it was not until two years afterwards, in 1837, (upon Mr. Grout's information, that a good second hand engine was to be disposed of at a comparatively low price,) that I was instructed to proceed to Cornwall for the purpose of purchasing it. The engine, which was a counterpart of the one at 'Fowey Consols' mine, already mentioned, was accordingly erected at the East London Water-Works, and was started in December, 1838. It worked very satisfactorily, and performed a duty of upwards of ninety millions."

Mr. Wicksteed has made a long series of experiments upon the engine during three years, and the work above mentioned contains the results he has arrived at, which may be briefly stated as follows:

1st. That little or no difference is perceptible between the results of slow and quick combustion; that the Cornish cylindrical boilers and method of working do not evaporate a greater quantity of water for the same quantity of fuel consumed than the old wagon-head boilers, ordinarily used for low pressure steam; and that "it would, therefore, appear that very little, if any, improvement has been made in the evaporative power of boilers since the days of the great, the immortal James Watt."

2d. That the duty of the Cornish engine experimented upon, is, for the same quantity of coals consumed, in the ratio of about two and a quarter to one to that of a Bolton and Watt engine upon the common construction, at the same works, with which it has been carefully compared.

Mr. Wicksteed gives a list of the causes to which he attributes this greater duty, and several elaborate tables accompany the work, forming altogether the most valuable collection of facts upon the subject which has yet appeared. The example of Mr. Wicksteed has been followed by other engineers, and engines of the same construction are now in course of erection for water-works in the neighborhood of London.

The paper alluded to merely gives the facts and results obtained by the experiments, but does not profess to go into the subject of their correspondence with theory; there exists, indeed, no sufficiently accurate theoretical investigation of the circumstances attending the action of the Cornish engine. It has been mentioned incidentally, in works upon the steam engine, particularly in the excellent one published a few years since by the Count de Painbour, but with not so much attention to the minutiae of the case as its peculiarity and importance would seem to demand. Some opinions have been expressed, and that, too, by parties of considerable practical experience, that the simple elastic force of the steam in these engines is insufficient to perform the work done, and that the deficiency is supplied by the effect of the *momentum* of the steam in entering the cylinder, and its consequent "*percussion*," as it is termed, upon the piston; but neither the deficiency of the one force, nor the existence, to any thing like an appreciable extent, of the other, has been proved by data of sufficient authority, or calculations sufficiently accurate, to warrant the adoption of these opinions, and they have consequently not been favorably received. It is, however, to be hoped that the general interest excited among engineers will induce some one, possessing the requisite ability and opportunity to combine theoretical investigation with practical observation, to turn his attention to the subject, and investigate it in such a manner as to satisfactorily account for and explain, upon exact mathematical principles, the circumstances of the case, and the causes of the superiority in point of economy of these engines; for by such a process alone may we expect to see any sufficient means proposed and adopted for introducing into steam engines generally the improvements, and realizing the advantages possessed by the Cornish ones. I have the honor to be, Colonel, your obedient servant,

GEORGE W. HUGHES, Capt. Corps Top. Eng., U.S.A.

Col. J. J. Abert, Chief Corps Top. Eng.

Pump Valves.—From the Minutes of the Proceedings of the Institution of Civil Engineers.

Mr. J. B. Jordan exhibited and described a model, showing the principal pump valves, used by mining engineers. Mr. Jordan stated, that the model before the meeting, was intended to illustrate mining machinery, and was one of a series, now in progress of construction for the Museum of Economic Geology. There were eight differently constructed valves in it, each surmounted by a glass valve-chamber and pipe; the large central pump, served to circulate the water through all the valves simultaneously, so as to show their comparative action; the water was then discharged from the collar launders over each valve, into that at the head of the pump, so that by repetitions of the pump-stroke, the circulation through the valves might be kept up at pleasure.

The valves shown in the model might be divided into four classes: 1st, those in which no attempt was made to counteract, or avoid, the violence of the beat, or concussion, on closing the valve; 2nd, those in which that evil was reduced, by dividing the horizontal area of the valve, into several parts; 3rd, those in which the same object was attained, by reducing the horizontal area of the moving parts of the valve; 4th, that in which the concussion was reduced to any desired amount, by making one side, or portion, of the column, to a certain degree, balance the other.

Valves of the first class were so well known, that they required little description; they were the common pump clack, moving on a leather joint, and having, generally, a very small water-way—the improved metal joint clack, in which the water-way was much increased—and the “button clack,” or, as it was called in Cornwall, “heantlebury’s clack,” which was a disk of metal with a central spill, or stalk, which rose and fell in a guide. Of these valves, the second was considered the best, inasmuch as it had the largest water-way, (some portion of which was direct) and it was free from some minor objections, to which the leather-jointed clack was liable. This valve was, therefore, in very common use in mine pumps, where the area of the pump, and the height of the column, were not such as to produce any serious inconvenience from concussion, in closing the valve.

In the second class of valves, the injurious effect of a violent beat was somewhat avoided, by the ingenious expedient of dividing the valve into several rings, or segments. The simplest of this class, was the well known “butterfly valve,” in which two semi-circular parts opened on a central hinge of leather, and the beat was divided into two parts; but as those closed at the same time, the concussion was principally reduced by the fall not being so great. The next valve was composed of several triangular pieces, opening on leather joints, from the circumference of the valve seating; it had been much used by Captain Reed, of the Mold Mines, Flintshire, and was reported of favorably, by several other mining engineers. It closed with a very

slight concussion, on account of the arc of each part being small, the base of each triangle forming the joint, while the water-way was large, and nearly all direct, admitting the mass of water to pass forward, in line parallel to the side of the pump. In the other valves of this class, no leather was used, a circumstance which rendered them more applicable to large pumps, where continuous working was of the utmost importance, particularly in the case of deep mines.

Fig. 1.

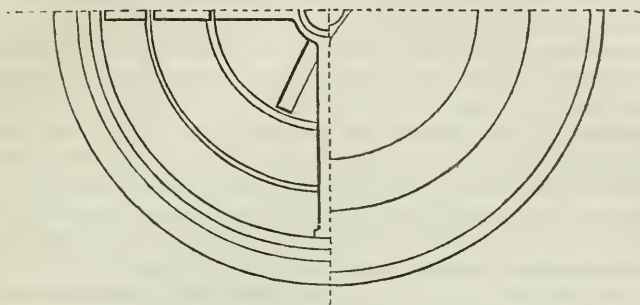
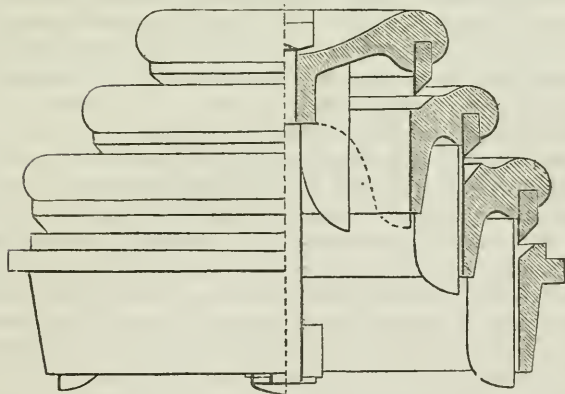


Fig. 2.



The two annular valves shown, were invented by Mr. Hosking, of the Perran Foundry, and Mr. Jenkyn, of the Copper-house Foundry, (Cornwall.) The first of these was composed of a series of rings working on a vertical spill, each ring having its seat on the one beneath it, (see figs. 1 and 2;) these rings have different areas, and fall in succession through a small space, compared with that which would be requisite, if the valve were in one piece, so that the concussion was much reduced, while the water-way was increased; but the latter being all lateral, it was requisite to have a large valve-chamber. The beats of this valve were formed of tin. Mr. Jenkyn's valve differed in construction from the one just described, in having the rings connected with each other by shackle-joints, instead of their working on a vertical spill; the mode of forming the beat was also

peculiar; it was composed of two thicknesses of leather, between which wedges of wood were driven into a groove, cast for their reception in the rings; these materials were so placed, that the edges of the leather, and the end grain of the wood, might form the striking surface of the beat, after being turned off in the lathe.

In the third class of valves, which avoided concussion by reducing the horizontal area of the moving parts, were Messrs. Harvey and West's, and Mr. Hosking's double-beat, and Mr. Darlington's cylindrical single-beat valves. The first of these was a modification of the double-beat steam valve, so long used in the Cornish engines; the second named was similar in principle, and was only slightly different in construction. They were both good valves, each giving large lateral water-ways, and, therefore, they required valve-chambers of corresponding size, to ensure their perfect action. Mr. Darlington's cylindrical single-beat valve, was contrived for a large set of pumps under his management, at the Alport Mines, (Derbyshire.) The rising column of this pump was 38 inches in diameter, and 22 fathoms in height; it was, therefore, desirable, in such a pump, to reduce the concussion as much as was consistent with the power of closing the valve in proper time; this was accomplished by causing a cylinder to rise over a metal ring packing in the seating of the valve, so much as to give a large lateral water-way under the beat, formed by the bottom of the cylinder. This valve was found to act well, but it required a very large chamber for the water to enter; the reason for adopting one, instead of two beats, was to avoid, or lessen, the leakage, caused by chips getting between either of the beats.

The only valve belonging to the fourth class, was that of Messrs. Palmer and Perkins; it consisted of an elliptical disk, moving on an axis placed parallel with, and near to, the minor axis of the ellipse, and closing at a considerable angle, against the interior surface of a cylinder. In a valve, so constructed, it would be readily perceived, that the concussion might be reduced to any extent, by bringing the working axis nearer to the geometric axis of the ellipse, because the force, with which it closed, must depend on the difference of area between the upper and lower portions of the disk. It possessed an advantage in the extent and character of its water-way, over all the other valves described, nearly the whole of the water-passage being parallel to the side of the pump. On the other hand, it was objected, that the axis would be liable to rapid abrasion, and, consequently, the valve would become leaky; but Mr. Jordan did not concur in the opinion of that being an insurmountable difficulty, and he hoped that the valve would be tried, under circumstances which would put its merits to a severe test.

Remarks.—Mr. Taylor said, that the subject of valves for pumps, had been so ably treated by Mr. Homersham, in his paper, which was read before the Institution last session, and, in the discussion upon it, that there remained but little for him to say. He could not, however, allow the model, which had been exhibited by the permission of Sir Henry De la Bêche, to pass without a few remarks.

In Cornwall, after the improvements in steam engines had made

considerable progress, attention was directed to the more perfect construction of the pumps. The plunger was introduced about that period, and the merit of it has been claimed by different parties;* its use was attended with many advantages, and had now become almost universal. Some of the benefits derived from its substitution, for the common piston, or bucket, had no reference to the subject of valves, and, therefore, need not be mentioned. In one point it was of great importance, for as the size of the water-way of the valves in the bucket was necessarily limited by the diameter of the working barrel, an arrangement like that of the plunger pump, which permitted both valves to be fixed in seatings, of which the areas might be increased to any convenient extent, became the more desirable; it was, therefore, extraordinary that such tardiness had been exhibited in taking advantage of such an obvious improvement, when the principle had been long known, and the loss of power, consequent on the former system, was admitted. The model which had been explained by Mr. Jordan, showed how much the attention of engineers had now been directed to the subject. In the discussion of Mr. Homersham's paper, Mr. Taylor had mentioned the advantage which had resulted from the extension of the water-way of some large pump-work, by having two suction-pipes, or wind-bores, and thus doubling the passage through the valves. It appeared important, for all the valves that discharged the water laterally, that more space should be provided round the seatings in which they were placed, and for want of that precaution, some excellent valves had not answered so well as they would otherwise have done. That which was invented by Mr. Darlington, to avoid some inconveniences in the use of the double-beat valves, would have been improved by an enlarged space around it. As mines increased in depth, and the volume of water became larger; as steam engines came into use, having a rapid and sudden motion, as compared with that of water-wheels, which were formerly universally employed for pumping, a great inconvenience was felt, from the concussion in the columns of the pumps; this was occasioned by the beating of the valves upon their seats, and in pumps, of the diameter needful for draining some of the mines, this evil became very serious. Almost all the improvements in valves were made with that view; the division of the old butterfly valve into segments, was an obvious first step; it had succeeded extremely well, and was still not much excelled. The annular valves of Hosking, Jenkyn, Simpson,† and others, were based on the admitted principle of dividing the falling clacks into several parts, that they should not rise so high, and that they might collapse in succession, and thus avoid concussion. Harvey and West's double-beat valve partook of that principle, but was stated to have the advantage of presenting a small area to be acted upon by the pressure of the column of water upon it. Darlington's valve, which was contrived to avoid the inconvenience

* The plunger was used by Sir S. Morland, in 1683, for the force pumps at the Machine de Marly.

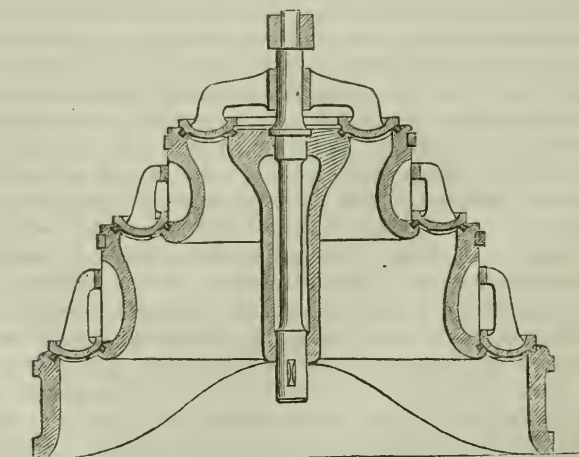
† The annexed engraving of a treble ring valve, fig. 3, is a section of Mr. Simpson's valve described by Mr. Homersham, in his paper of last session before referred to. It is a con-

arising from the leakage, from both the seats of Harvey and West's valve, when any substance obstructed its perfect closing, presented also a small area for the pressure to act upon; but as it discharged the water laterally, it required an increased space around the seating.

The model exhibited a valve, introduced by Messrs. Palmer and Perkins, upon a principle, by which concussion might be considerably reduced, by bringing into action a part of the superincumbent pressure, to check the descent in closing the orifice. This valve had not yet been tried in large pumps; but the opinion of practical men appeared to be in its favor.* In the construction of all valves, it was of importance, not only to attend to the points which had been mentioned, but also to their durability, and their facility of removal and repair. The actual cost of the valves was of little importance, when compared with the labor and hindrance in removing, or cleaning, them, where the influx of water was great. Serious expense, and loss of time, were frequently occasioned by such stoppages, and the deeper parts of the mines were exposed to obstructions, which were overcome with great difficulty, notwithstanding many ingenious and well arranged contrivances, to render the process of repair easy and expeditious. Very powerful capstans, and other means were pro-

cal valve formed of rings, shutting down upon separate seatings, allowing a passage for the water both inside and outside the rings. Valves of this construction have been introduced at the Lambeth and Chelsea water-works. The valve at the Lambeth works is 30 inches in diameter, the perpendicular rise, or lift, when fully open, does not exceed $1\frac{1}{2}$ inches. The clear, uninterrupted area through which the water passes, is more than two-thirds of the whole area of the valve, the internal diameter of the scaling being 27 inches. The valve at the Chelsea works is $43\frac{1}{2}$ inches diameter, and the greatest height to which the rings of the valve rise, does not exceed $2\frac{1}{4}$ inches.

Fig. 3.



* A valve of a very similar construction is described in Belidor's "*Architecture Hydraulique*," vol. iii, p. 221, as having been introduced by him in 1737, for the improvement of the water-works at the Pont Notre Dame, Paris. The situation of the pivot of the valve, is described to be at one-twelfth part beyond the line of the geometrical diameter of the pump barrel.

vided for these emergencies, and as the labor of fifty, or sixty, men was sometimes required to work these machines, it would be easily conceived how important it was, that such operations should occur as seldom as possible, and that the most perfect and durable construction should be aimed at.

Mr. Perkins observed, that although, at the first view, a certain degree of resemblance might appear to exist between Belidor's valve, and the disk valve of Palmer and Perkins, there existed, in reality, but little similarity between them. The former was placed horizontally, whether used as a clack, or as a bucket; in all cases it required to be adjusted to a seating formed of reversed cones, like the ring of a steam throttle valve, and it was always attached to a packed bucket, or piston. Whereas, the latter worked at an inclination of about $\frac{1}{4}$ th of the diameter of the pump; it was adjusted within the bored pipe without any seating, and it formed a piston without any packing. Its form being that of an oblique section of a solid cylinder, whose diameter was equal to the interior of the working barrel, and the line of its suspension being beyond the diameter, the areas of the two portions of its surface were unequal; consequently, there was more pressure on one side of the line of suspension than on the other. By this extra amount of pressure, the disk was turned on its axis, allowing a free passage for the water parallel with the sides of the pump. The closing of the lower valve on the return stroke, was, for this reason, without noise, or concussion. It was evident, also, that as packing was not necessary for the disk piston, and as the rubbing surface of its periphery was very small, the friction must be greatly diminished. Messrs. Bramah and Robinson made an experiment for comparing a pump, with a packed bucket and butterfly valves, with one having a disk piston; the diameter of both pumps was 10 inches, with a stroke of 8 inches, a lever of six to one, and a lift of water of 5 feet; it was found that the former required a force equal to 460 lbs., and the latter 196 lbs. to complete a stroke. As regarded their duration, a disk pump 7 inches diameter, with a stroke of 8 inches, and a lift of 40 feet, drawing its water through 600 feet of suction pipe, rising, in that length, 28 feet vertically, and worked by a steam engine 26 strokes per minute, had been found, after working nearly night and day, at the Equitable Gas Works, during fifteen months, without repair, to exhibit but little appearance of wear in the piston, and both it, and the clack valve, were perfectly tight. As the subject appeared to interest the Institution, he promised to present, on a future occasion, a more detailed account of some similar pumps, with the actual results obtained.

Mr. Lowe corroborated the statement of the efficiency and duration of the valve used at the Equitable Gas Works; its friction was necessarily very small, for as it formed, at the same time, both piston and valve, and in the return stroke, from its nearly vertical position in the working barrel, the parts in contact were reduced to the area of the points of the minor axis of the disk, the friction was in proportion to that area. As a seat valve, he thought it less liable to become defective than any other, as it was scarcely possible for any sand, or other

foreign matter, to lodge upon it, and the valves which he had seen at work did not show any symptoms of being so affected.

Mr. Farey said, that it was an axiom relative to steam engines, that their action became more perfect as their size increased, but that this could not apply correctly to pump valves; for, as their size had augmented, the difficulties in their construction had been more fully developed. With small valves it had been considered, that the vertical height of the lift of a clack should be one-fourth of the diameter of the barrel, but it was evident that rule could not be adhered to with large valves. Other forms, allowing a free passage for the water, had, therefore, been resorted to, and with great success, but there was still room for improvement. He had a high opinion of the valve which had been used originally by Messrs. Boulton and Watt, and which was called, from its form, the "Bishop's cap." It consisted of four triangular flaps of leather, hinged on the periphery of the valve, and meeting in the centre; the number of these flaps had been, he believed, increased to six and eight for very large sizes, and they afforded a very free passage for the water. Much yet remained to be done in improving the valves of the air-pumps of steam engines, especially in adapting them to the speed of the engine, so as to avoid the loss of power consequent on drawing, or forcing, the water through contracted passages.

Mr. Jordan was happy to find his opinion of the disk valve corroborated. He had viewed it almost entirely as a clack valve, on which the whole weight of the column of water would rest, and for that purpose he thought it particularly suited. He could not agree in the opinion that chips of wood, or other substances, would be liable to accumulate near the axis, and render it leaky. He thought, on the contrary, that it would clear itself very easily, and as the faces, or seats, were vertical, it was not possible for any thing to rest upon them. It had been urged, that these valves were difficult of construction, and would scarcely be found tight under a very heavy column. He conceived, however, that with modern machinery, there could not be any trouble in making them perfectly accurate, and that the simple addition of a beard of leather, fixed on the upper side of the longer portion of the valve, and to the seating at the shorter part, would render the valves quite tight.

Mr. Homersham observed, that any particular form and proportion of a valve, which enabled it to answer well in one situation, was no criterion of its doing the same under other circumstances; for instance, the suction and delivery valves of the pump of a Cornish mine engine, required to be differently proportioned, as, in order to follow the speed of the plunger, the water was obliged to move through the former more rapidly than through the latter; for the velocity of the down stroke of the steam piston of a Cornish engine, was chiefly regulated by the portion of the stroke at which the steam was cut off, whereas its velocity in going out was most usually adjusted by varying the period of the pause at the end of the stroke; although it was also somewhat governed by the number of strokes per minute which were required to be made. Therefore, as the plunger always

moved quicker in the former, than in the latter case, the velocity of the passage of the water through the suction valve (unless its area were increased,) was greater than through the delivery valve, and the moving part of the valve, against which the water impinged, required to be heavier in the former than in the latter, to insure its closing before the return stroke of the engine commenced. This had been pointed out in his paper on valves, which was read in the last session, and a rule was given* for their relative weights, which should always be in proportion to the velocity of the water passing through them; if this were not attended to, and they were both made of the same weight, the delivery valve would not open freely, and thus more weight would be required to carry the engine "outside," and the duty would be diminished. He was, therefore, of opinion, that every valve required to be adjusted expressly for the situation in which it was placed, and the duty it was required to perform.

Mr. Galloway drew the attention of the meeting to a pump which was introduced by Mr. Jacob Perkins, in 1820,† and was rewarded by the Society of Arts. The barrel consisted of four boards, nailed together, so that its horizontal section formed a square. The bucket rod was enlarged to a broad end, intersecting the square diagonally; to this two valves were affixed by leathern hinges. Their form was that of an isosceles triangle, the base of each being united to the rod, and the other sides resting, in an inclined position, against the inner sides of the barrel, filling the entire area. In the down stroke of the bucket, this form offered little opposition to the water, and was sufficiently tight for common purposes, with but little friction. Mr. Galloway subsequently constructed a pump with a wooden barrel, in which the valve was in one piece; the preponderating action, like that of the oval disk pump, was effected by giving the barrel the form of a trapezium, the valve being suspended by an axis, which crossed it at the bases of the two unequal parts. Neither the trapezium valve, nor that of Jacob Perkins, were, he conceived, generally applicable; their utility would not extend beyond domestic purposes, or those countries where the means of boring cylindrical barrels were not attainable. Mr. Galloway was of opinion, that the principal objections to the elliptical disk valve were, first, that as the axis of the valve did not coincide with the minor axis of the ellipse, the spindle would either bend, on the valve being raised to a vertical position, or it would not fit the cylinder when it was shut; secondly, that there was no compensation for abrasion across the minor axis, so that when the valve was worn, either by the friction of sand, or from other causes, it would become leaky. Mr. Galloway then exhibited a form

* The following is the rule referred to by Mr. Homersham: "The mean velocity of the water in feet per second through the valve being ascertained, one half more is added, and considered as the maximum velocity of the water through the valve, and the height of the head of water being found that would produce the velocity, every $1\frac{1}{2}$ inches of such height is then considered as equal to an ounce weight avoirdupoise acting upon every square inch contained in the area of the valve, against which the water impinged in its passage to the pump barrel, allowance being made for the difference of the weight of the ring when immersed in water; compared with its weight in the air."

† Vide "Transactions of the Society of Arts," 1820, vol. xxxviii, p. 106.

of valve, by which he submitted these objections would be obviated. If an ellipse was intersected diagonally, at an angle of 45° with the major and minor axes, and one portion was turned over, so as to produce a heart-shaped figure, when joined to the other portion by a hinge, it was obvious that these two leaves, when placed in a cylinder, would fill the cavity as the original ellipse had done; both the minor and major axes being at different angles. These leaves being supported from beneath by rods with ball and socket joints, the wear in any direction, would be compensated by the extension of the leaves, as their constant tendency was to become horizontal. The rocking rods, acting at points on the leaves, where the preponderance of surface was in one direction, enabled the water to open and close them, with that easy motion which was so much desired in heavy lifts.

Mr. Jordan wished it particularly to be understood, that he had directed attention to the disk valve, hoping that from its simplicity of action, it might be tried and found serviceable, for the clacks of deep mine pumps, of large diameter, and working under a column of from 10 to 50 fathoms in height. There was little doubt of the valve being tight under ordinary circumstances, and with short lifts, but when a heavy column of water was allowed to rest upon a valve, the slightest inaccuracy was detected.

Mr. Homersham differed in opinion with Mr. Jordan, as to the applicability of the disk valves to deep mine-pumps. He conceived there would be a certain amount of difficulty in constructing them so as to be perfectly tight under a heavy column of water, and the spindle or pivot of the valve would require to be of large diameter, to insure its being strong enough to bear the pressure. It was also necessary, for the perfect action of the valve of a pumping engine, that it should be closed by the time the piston of the pump arrived at the top or the bottom of its stroke; this could only be accomplished by the weight of the valve balancing the maximum velocity of the water put in motion through it, so that it should begin to close as the flow of water diminished, and be quite closed when the motion of the piston ceased; this, he conceived, would be difficult to accomplish with the valve then under consideration.

Mr. Palmer remarked, with reference to these objections, that the opinions given were clearly in opposition to facts deduced from fifteen months' operation of this pump, raising water under a vertical column of 40 feet, during which period, the slip, or loss, of water approached nearer to the calculated result than any pump duty that had come under his observation. In reference to the second objection, it was quite clear the valve-spindle must be of adequate strength, to support the column of water the pump had to lift: he believed that no greater evil (considered in an abstract sense) could result from the use of a large spindle, than an increased friction at its bearings, and a corresponding loss of velocity in the fall of the valve. These evils were, however, neutralized by increasing the eccentricity of the spindle, and thereby enlarging the valve's area above the spindle, which increased area would always be considered, in reference to the altitude

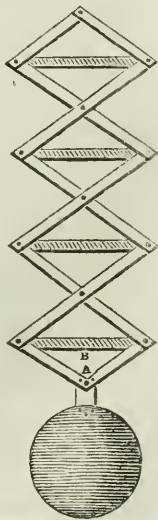
of the column of water above the valve, in order to insure the least loss of water, and at the same time, to avoid the percussive action so detrimental in other pumps. As regarded the third objection, namely, that there would be great difficulty in keeping the disk-valve perfectly tight; he would remark, that in the pump referred to, the minor axis of the piston was not sensibly worn, while the major axis was shortened $\frac{3}{8}$ ths of an inch, but still preserving the true elliptic form, and fitting the pump as accurately as when first put into action, although the piston had made upwards of 16,800,000 double strokes, and had traveled over a rubbing surface exceeding, 2,100 miles, during the upward or effective stroke. The wear of the clack-valve at the major axis was less than $\frac{1}{30}$ th part of an inch, while at the minor axis it had undergone no change, although the number of beats it had made equalled the number of strokes of the pump. The modifications of the elliptic disk piston and valve into the trapezium form, as proposed by Mr. Galloway, appeared to him to be attended, not only with a considerable increase of cost in the manufacture and the fitting of the trapezium valve, and the working-barrel, but also increasing the amount of rubbing surface, with a corresponding amount of wear and tear, as compared with a pump having the elliptic valve performing the like amount of duty. The two semi-elliptic valves proposed by Mr. Galloway, were ingenious, but they were contrived with the view of remedying an evil that did not really exist in the disk-elliptic piston valve, namely, wear and tear of the minor axis, and leakage at the parts supposed to be worn; nor would the action of the two elliptic leaves, he conceived, be as efficient as the simple elliptic disk piston valve.

Civ. Eng. & Arc. Journ.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

A Compensating Pendulum.

In the last number of your Journal (August,) there is proposed a method of forming compensating pendulums of a single piece of metal.— Since reading the article, the following modification has occurred to me, which, if found to obviate the defects noticed by Mr. T. E., may be of use to some of your readers. Instead of a single triangle, let the pendulum consist of a single piece of sheet metal, cut as represented in the adjoining figure. Mr. E.'s reasoning is as applicable to the combined triangles, here shown, as to the single one; so that the perpendicular distance A B, (if the sides and diagonal are rightly proportioned to one another,) will remain constant, and the same here as in the single form. Thus, a pendulum may be obtained of any required length without an inconvenient width, and possessing sufficient practical rigidity.



O. K.

Chowan county, N. Carolina, Aug. 20, 1844.

VOL. VIII, 3RD SERIES. No. 4.—OCTOBER, 1844.

the shorter one A B, lessen the perpendicular distance A C. The same reasoning may, of course, be applied to the remaining half (E C A,) of the pendulum.

O. K.

Chowan county, N. C., Aug. 21, 1844.

Storm-Glass.

The storm-glass is a very elegant and economical little "weather-wise," which deserves more attention than it has yet received. It is usually, indeed, to be found at the shops of the philosophical instrument makers and opticians, but its real merits are comparatively little known. This is perhaps owing to its great simplicity and cheapness—few believing that the meteorological indications of an instrument of such unpretending appearance, and which every one may make for himself at so trifling a cost, are at all to be relied upon. For some purposes, however, it is more worthy of dependence than instruments of fifty times its price, and its indications are always accompanied with interest, and often with astonishment, in those who are unacquainted with the principle.

To prepare the instrument, take two drachms of camphor, half a drachm of pure nitrate of potash, (nitre, or saltpetre,) and half a drachm of muriate of ammonia, (sal-ammoniac,) and triturate them together until they are thoroughly pulverized. The operation may be assisted by adding a few drops of alcohol. When well triturated, the mixture is to be dissolved in about two ounces of proof spirits, (good whiskey,) and put into a tall phial, as an *Eau de Cologne* bottle, or into a glass tube of about ten inches in height and three-fourths of an inch diameter, the mouth of which is to be covered with a bit of bladder, or the like, perforated with a pin. The instrument is then complete.

The indications which it gives are of this nature:—If the atmosphere be dry, and the weather promising to be *fine*, all the solid part of the composition which appears in the glass will be closely collected at the bottom, and the liquid above will be quite clear; but on the approach of a change to rain, the solid matter will appear gradually to rise, and small crystalline stars will be observed to float about in the liquid, which, however, will remain otherwise pellucid. On the approach of winds, flocks of the composition, apparently in the form of a leaf, will appear on the surface of the liquid, which, in this case, will seem thick, and in a state of fermentation. These indications often begin to exhibit themselves twenty-four hours before the actual breaking forth of the storm; and after a short experience in observing the changes of appearance of the materials in the glass, not only the magnitude of the coming storm will readily be estimated, but likewise its direction; for the quarter of the compass from which the wind blows will always be indicated by the circumstance of the solid particles lying more closely to the side of the glass opposite to that whence the tempest comes. During the winter, the composition is rendered white by the multitude of small white stars which are con-

stantly floating about in the liquid; this is particularly remarkable during white frost and snow. In summer, on the contrary, when the weather is warm and serene, the liquid is clear, and the solid matter lies at the bottom of the glass.

Some of these indications are as yet unaccounted for; but the leading principle is the solubility of camphor in alcohol, and its insolubility in water, combined with the well known meteorological fact, that the drier the atmosphere, the more aqueous vapor does it take up, and *vice versa*. When, therefore, the weather is warm and dry, a quantity of the water of the menstruum is drawn off in the form of vapor, and, consequently, more of the camphor enters into solution; and, on the contrary, when the air is surcharged with moisture, that moisture begins to be deposited, and the menstruum again will be weakened, and a quantity of the camphor is precipitated from the solution in the form of little crystalline stars. This may easily be proved by making an alcoholic solution of camphor, and adding a few drops of water.

Glasgow Mech. & Eng. Mag.

On Loud Beats of Clocks used in Observatories. By J.S. EIFFE, Esq.

This paper gives an explanation of a simple and easily applied method of obtaining very loud beats for the astronomical clock. The mode of constructing the apparatus is as follows:—Two pieces of thin brass are placed at the sides of the frame work of the clock, in length the same as the space between the pillars; in width about two inches, or more, at pleasure; these pieces of brass are placed horizontally at about the same altitude from the base as the axis of the escape-wheel pinion, and at the right angles to it, or nearly so. They should be made of such a size as would insure a sound, distinct, sharp, and short. The little tables can be made to any size. Upon these tables, or plates, two hammers ply, supported by arbors at the same elevation as all the others. The pivots should be made small for easy motion. The hammers are intended to beat upon the middle of each brass table simultaneously with the drop proper of the escape wheel: through the agency of the pendulum, they are lifted alternately by the heels of the anchors of the pallets, assisted by a passing spring similar to that used in the chronometer escapement. It has just been observed, that the arbors which support those little hammers are placed at the same elevation from the base of the brass frame work of the clock as the escape wheel arbor, but at the sides, and as near to the edge as possible. About the centre, or midway between them, are affixed brass collets, about one-eighth of an inch in thickness, and one-fourth of an inch in diameter. Two slender pieces of spring are secured to the collets by screws passing through square holes formed longitudinally, to secure power of adjustment for bringing the arms into proper contact with the anchor of the pallets. The little hammers beat upon the plates, or tables, at one end, and at the other the lifting action takes place, assisted by the passing spring. The strokes upon these

brass tables have a peculiar sharpness of tone, which can be accounted for, in some measure, when it is considered that they are very different from the sounds produced by the teeth of the wheel itself; in the dead-beat escapement the teeth have a sliding motion in the moment of drop, but not impulse, for it is well known that that is subsequent to the sound. By such application it is proposed to obtain sound so loud as to be *distinct in the stormiest night*; but as the constant connexion of such apparatus would neither be desirable as concerns the action of the clock, nor pleasant to the ear as a companion, a mode has been introduced of readily detaching it altogether. By a certain method, which shall be explained, the hammers are raised from the tables at one end, and the arms at the other entirely disengaged from the anchor at the pallet, without inconvenience, or disturbing the action of the clock itself. The apparatus within is immediately, and at pleasure, acted upon through the agency of a bolt, which is placed vertically, immediately over the sixty minutes, or about two inches back, sufficiently long to reach a spring of hard brass, which is about half an inch wide, and which passes transversely over the frame work of the clock, and is fixed securely to the back board of the clock case. Now the mode in which the spring unites its action with the rest of the apparatus is by slight cross-bars, which extend to the extremities of the sides of the frame, so that the ends are immediately over the hammers, with which they are connected by silk threads. Therefore, by pressing down the bolt before named, the hammers are allowed to fall into action, and do their duty simultaneously with the teeth of the wheel upon the pallets. While the little hammers are in action, the teeth of the wheel are no longer heard.

The Astronomer Royal declares by letter, that he has examined the plan, and is enabled to say that it answers completely for its proposed purpose; and that it appears likely to be very useful. Moreover, that the rate of the clock will not necessarily be disturbed during the time of its connexion—though that will greatly depend on certain conditions.—(*Proc. Astron. Soc., Lond.*)

Lond. Athenæum.

An Account of the Erection of the Herschel Obelisk at the Cape of Good Hope, accompanied by the Report of Col. Lewis, and a Plan of the same. By THOMAS MACLEAR, Esq.

The following is an abstract:—Sir John Herschel, during his residence at the Cape, was President of the South African Literary and Scientific Institution. When he was about to leave the colony, the members expressed a desire to present him with some token of remembrance; and, at a full meeting, a few days before his departure, a gold medal was presented, with the impress of the Institution on one side, and a suitable inscription on the reverse. The feelings excited on that interesting occasion strongly evinced how much the members regretted the loss of their president, and their admiration of one whose talents place him so far above ordinary men, and whose

private life was a pattern of every domestic virtue. The sum subscribed having exceeded the expense of the medal, another subscription list was opened, with the intention of raising a fund for the purpose of placing a substantial structure on the site of the twenty feet reflector in the garden of Sir John's late residence at Feldhausen. The proposal was accordingly laid before Sir George Napier, who entered warmly into the project, and placed his name at the head of the list annexed to a handsome subscription. In the course of a few days the sum subscribed amounted to 190*l*. At a general meeting, held on the 28th of November, 1838, the erection of the obelisk was finally determined on; and a committee was appointed to carry its erection into effect. A fruitless attempt to procure a granite column at the Cape, of proper workmanship, and within the resources of the committee, led to the adoption of a suggestion, that one of Craigleith stone, from the quarry near Edinburgh, might be obtained without difficulty, and of superior finish. A resolution was accordingly passed by the committee, which, together with a plan of the proposed obelisk, was forwarded to Professors Forbes and Henderson, of Edinburgh, with a request that those gentlemen would kindly undertake the necessary superintendence of the work; a request to which they acceded with alacrity,—and the obelisk, in packing cases, arrived in Table Bay in the month of August, 1841, where it was safely landed, under the guidance of Col. Lewis.

The following is the report of Colonel Lewis on the erection:—"In excavating the foundation, which was of black sand, it was found necessary to go down 4 feet 10 inches, to arrive at the iron stone gravelly bed, the substratum of the country about Feldhausen. The masonry foundation was formed of concrete, built up in courses of 12 or 14 inches, and composed of iron stone, gravel, and lime mortar, well grouted together. On this masonry bed a granite platform 9 feet 6 inches square was laid, and the small column fixed by Sir John Herschel on the site of the 20 feet reflector. This mark was removed for a few days, in order to bring the masonry foundation to a proper height, but the mark was relaid with mathematical correctness by Lieut. Laffau, Royal Engineers. Previously, however, to relaying the Herschel mark, the suggestion of the committee of construction was adopted of placing under it several silver and copper coins, a few inscription medals, and medals of the South African Institution, struck in silver for the occasion; and on the obverse were engraved some notices, statistical and geographical, of the colony; the discoveries of Capt. Ross in the South Polar Regions in 1841, and the operation of remeasuring the arc of the meridian in 1842. These subjects were beautifully executed by Mr. Piazza Smyth, assistant astronomer, and hermetically sealed in glass bottles. Also there were deposited a map of the colony, and engravings of nebulae, observed at Slough, from 1825 to 1833, by Sir John Herschel, and a plan of Mr. Maclear's triangulation, connecting the site Feldhausen with the Royal Observatory, and the site of La Caille's observatory, in Strand street, Cape Town. The bottle was carefully fixed in a block of teak wood, scooped out on purpose. When the granite platform was brought to

its level, and the Herschel mark refixed and filled in with cement, it was necessary to erect heavy shears of large spars, to place the stones of the obelisk, composed of large blocks of Craighleith stone, some weighing two tons. This was accomplished with some trouble and expense, and the base of the obelisk was laid with the faces corresponding with the four cardinal points. The whole was completed on the 15th of February, 1842, in presence of some of the committee, and several of the subscribers and friends of Sir John Herschel, who attended on the occasion of placing the top stone of the obelisk. The obelisk has the base 6 feet square by 6 feet in height, and the pyramidal part stands 12 feet above the base. On the east face is an opening showing the Herschel mark, designating the site of the 20 feet reflector. The opening will be closed with a bronze plate, containing the inscription of the purpose for which the obelisk is erected."—*Proc. Astron. Soc., Lond.*

Ibid.

Energiatype, a new Photographic Process. By ROBERT HUNT.

While pursuing some investigations, with a view to determine the influence of the solar rays upon precipitation, I have been led to the discovery of a new photographic agent, which can be employed in the preparation of paper with a facility which no other sensitive process possesses. Being desirous of affording all the information I possibly can to those who are anxious to avail themselves of the advantages offered by photography, I solicit a little space in your columns for the purpose of publishing the particulars of this new process. All the photographic processes with which we are at present acquainted, sufficiently sensitive for the fixation of the images of the camera obscura, require the most careful and precise manipulation; consequently, those who are not accustomed to the niceties of experimental pursuits, are frequently annoyed by failures. The following statement will at once show the exceeding simplicity of the new discovery.

Good letter paper is first washed over with the following solution:

A saturated solution of succinic acid,	2 drachms.
Mucilage of gum arabic,	$\frac{1}{2}$ "
Water,	$1\frac{1}{2}$ "

When the paper is dry, it is washed over once with an argentine solution, consisting of one drachm of nitrate of silver to one ounce of distilled water. The paper is allowed to dry in the dark, and it is fit for use. It can be preserved in a port-folio, and at any time employed in the camera. This paper is a pure white, and it retains its color, which is a great advantage. At present I find it necessary to expose this prepared paper in the camera obscura for periods varying with the quantity of sunshine, from two to eight minutes, although, from some results which I have obtained, I am satisfied that, by a nice adjustment of the proportions of the materials, a much shorter exposure will suffice. When the paper is removed from the camera, no trace of a picture is visible. We have then to mix together one

drachm of a saturated solution of sulphate of iron, and two or three drachms of the mucilage of gum arabic. A wide, flat brush, saturated with this solution, is now swept over the face of the paper rapidly and evenly. In a few seconds the dormant images are seen to develop themselves, and with great rapidity a pleasing negative photographic picture is produced. The iron solution is to be washed off as soon as the best effect appears, this being done with a soft sponge and clean water. The drawing is then soaked for a short time in water, and may be permanently fixed by being washed over with ammonia, or perhaps better with a solution of the hyposulphite of soda, care being taken that the salt is afterwards well washed out of the paper. From the picture thus produced, any number of others, correct in position, and in light and shadow, may be produced, by using the same succinated papers in the ordinary way, from five to ten minutes in sunshine producing the desired effect.

The advantages which this process possesses over every other must be, I think, apparent. The papers are prepared in the most simple manner, and may be kept ready by the tourist until required for use. They require no preparation previously to their being placed in the camera, and they can be preserved until a convenient opportunity offers for bringing out the picture, which is done in the most simple manner, with a material which can be any where procured.

Anxious to give the public the advantage of this process during the beautiful weather of the present season, I have not waited to perfect the manipulatory details which are necessary for the production of portraits. It is sufficient, however, to say, that experiment has satisfied me of its applicability for this purpose.

Prismatic examination has proved that the rays effecting this chemical change, are those which I have elsewhere shown to be perfectly independent of solar light, or heat. I, therefore, propose to distinguish this process by a name which has a general, rather than a particular, application. Regarding all photographic phenomena as due to the principle *Energia*, I would, nevertheless, wish to distinguish this very interesting process as the *Energiatype*.

I enclose you a few specimens of the results already obtained. The exceeding sensibility of the *Energiatype* is best shown by an attempt to copy engravings, or leaves, by it. The three specimens I enclose, were produced by an exposure of considerably less than one second.
—*Athenæum*.

In a subsequent number of the "*Athenæum*," Mr. Hunt has given the following additional directions:—

Experience has suggested to me the advantage of adding to the solution of succinic acid and gum, as previously given, five grains of common salt. This preserves the lights very clear, and, indeed, improves the sensibility of the paper.

When the solution of the sulphate of iron is laid over the paper, it is requisite to keep disturbing it, by rapidly, but lightly, brushing it up; otherwise numerous little black specks form, which destroy the photograph. If, as sometimes happens, the surface of the picture blackens all over, it must not be concluded that the drawing is des-

stroyed. The whole of this superficial blackness may be removed by immediately washing with a wet sponge. If the lights become in any way discolored, a little exceedingly diluted hydrochloric (muriatic) acid will restore them to their proper degree of whiteness; but care must be taken that the acid is speedily washed off, or the shadows will suffer.

When, from the shortness of the exposure, the image develops itself slowly, or imperfectly, a slight degree of warmth brings out the picture with rapidity and force. Holding the paper a short distance from the fire is the best mode of operating.

Lond. Reper. Pat. Inven.

*Note on a Means of Preserving the Crystals of Salts as permanent objects for Microscopic Investigation. By ROBERT WARRINGTON, Esq.**

Having occasion lately to require the crystals of various salts, in a state fitted for examination, by polarized light under the microscope, and as the preparation of these crystals was frequently attended with much trouble and loss of time, it became a point of importance to render the object, when once perfected, permanent, so that the investigation of certain individual crystals could be repeated, and additional observations made at any period. This was rendered the more desirable from the difficulty of obtaining perfect and isolated subjects, and the rapidity with which many of these undergo alteration by exposure to the air. With some few salts this operation was comparatively easy, as the Canada balsam offered an excellent medium for the purpose, but in the greater number of cases I have examined, it proved totally indifferent; and this arises from two causes, the first from the action of the turpentine contained in the balsam rendering the surfaces of the crystals opalescent; the second, from the heat, which it was necessary to apply to make the balsam sufficiently fluid to displace the atmospheric air, fusing the salt in its water of crystallization, or rendering it opaque from the loss of water. Olive oil on trial appeared a good medium for all cases, but was objectionable from its fluidity, and from its depositing its stearine in cold weather. Castor oil was then tried, and this I have adopted with great satisfaction.

The method to be adopted in mounting these specimens is as follows:—A warm saturated solution of the salt required is to be prepared, and a drop of it placed upon the glass slider, on which it is intended to be permanently mounted, and allowed to crystallize; when a good group of crystals is obtained, the uncrystallized portion is to be cautiously removed; this is best effected by drawing it gradually away in a small stream along the edge of the slider, having previously broken through that part of the crystalline ring adjacent to the edge; the salt is to be allowed to drain itself quite dry by placing the slider on its end in a vertical position. It should next be examined under the microscope, to ascertain the fitness of the crystals for the

* Communicated by the Chemical Society; having been read January 15, 1844.

purpose required, because many salts separate from their solutions in crystals too thin to exhibit any prismatic colors when viewed by polarized light, appearing only of a pearly, or silvery, aspect, while others form in the opposite extreme, and are totally unfit, from their thickness, for investigation. Presuming, however, that the crystals are such as the investigator requires, the next step is to drop on a small quantity of castor oil; that which has been filtered cold must be employed, as otherwise it is liable to the same objection as olive oil, and care must be taken that it covers the whole of the salt, and has displaced all the particles of atmospheric air that may have been adhering to the crystals. This having been done, a small piece of very thin glass is to be carefully placed on the surface of the oil, and any excess which may, by this means, have been pressed out, cautiously removed by bibulous paper from the edges. Two or three coats of a strong varnish of shellac, as ordinary sealing-wax in spirits of wine, or jappanners' gold size, are then to be placed round the margin, so as completely to inclose the oil, and the crystals are permanently preserved for observation. It may be perhaps as well to observe, that the one layer of varnish must be allowed to dry for about twenty-four hours before the next is applied, and that during this time the slider must be maintained in a flat position.

Lond., Edin., and Dub. Philos. Mag.

On the Chlorides of Gold.

Great difficulty has hitherto occurred in preparing the chloride of gold, of the yellow and red colors, perfectly soluble in water, and without suffering reduction. The following processes are recommended for this purpose:—

1st. In order to prepare the yellow salt of gold, take *aqua regia* prepared with three parts of hydrochloric acid, one part of nitric acid, and one of distilled water. Then put one part of pure gold into a porcelain capsule, and pour the *aqua regia* upon it; cover the capsule with a plate of glass, and heat it in a salt water bath, the heat being continued till red vapors cease; the cover is then to be removed, and if the gold is not entirely dissolved, some *aqua regia* is to be added to it; the capsule being again covered, the heat is to be continued till vapor ceases to appear; the glass plate must then be removed, and replaced by folds of blotting paper, the heat being continued in the bath until a glass rod being immersed in the capsule, it becomes covered, on removing it, with yellow, solid chloride of gold.

The capsule is then to be removed from the salt water bath, and the chloride of gold soon crystalizes in small prismatic crystals, of a fine yellow color, with an orange tint. The chloride, thus obtained, is perfectly soluble in water without reduction; it is successfully employed in Daguerréotype and other operations.

The red chloride of gold (terchloride) is prepared in the same manner, except that the *aqua regia* employed is prepared with two parts of hydrochloric, and one part of nitric, acid. The operation is com-

menced by acting upon gold with excess of *aqua regia* on a sand bath, the salt water bath not being used until the gold is entirely dissolved; the remainder of the operation is conducted in the same manner as that for the yellow chloride.—*Journ. de Ph. et de Ch., Mai*, 1844.

Ibid.

Improvement in the Daguerriotype Process.

A communication was made by M. Daguerre to the Paris Academy of Science, relative to some improvements in the Daguerriotype process, chiefly for the purpose of taking portraits, the ordinary mode of preparing the plates not being found sufficient to enable the operator to obtain good impressions. The improvement made by M. Daguerre, requires a rather complicated process, but it is a very regular one, and has one decided advantage, for the artist is now enabled to have a good stock of plates on hand, as the new preparation will remain for a very long time in a perfectly fit state for use. The new substances of which M. Daguerre makes use, are an aqueous solution of bi-chlorure of mercury, an aqueous solution of cyanure of mercury, oil of white petroleum, acidulated with nitric acid, and a solution of platina and chlorure of gold. The process is as follows:—the plate is polished with sublimate and tripoli, and then red oxide of iron, until a fine black be obtained; it is now placed in the horizontal plane, and the solution of cyanure, previously made hot by the lamp, is poured over it. The mercury deposits itself, and forms a white coating. The plate is allowed to cool a little, and after having poured off the liquid, it is dried by the usual process of cotton and rouge. The white coating deposited by the mercury is now to be polished.—With a ball (*tampon*) of cotton saturated with oil and rouge, this coating is rubbed just sufficiently for the plate to be of a fine black. This being done, the plate is again placed upon the horizontal plane, and the solution of gold and platina is poured over it. The plate is to be heated, and then left to cool, and the liquid having been poured off, the plate is dried by means of cotton and rouge. In doing this, care must be had that the plate be merely dried, not polished. On this metallic varnish, M. Daguerre has succeeded in taking some very fine impressions of the human figure, which were exhibited.

London Athenæum.

Lunar Occultations.

Lunar Occultations visible in Philadelphia, computed by MRS. CHARLOTTE S. DOWNES, from the Elements published with the Occultation list for the United States Almanac.

The Immersions and Emersions are for Philadelphia, mean astronomical time. Im. for Immersion, Em. for Emersion. These abbreviations in *Italics* refer to those Immersions and Emersions which take place on the Moon's dark limb. N. App. for Near Approach.

The angles are for *inverted image*, or as seen in an astronomical telescope, and reckoned from the Moon's North point and from its Vertex around through East, South, West, to North and Vertex again. For direct vision add 180° .

OCTOBER, 1844.

Day.	H'r.	Min.	Star's name.	Mag.	From North.	From Vertex.
1	17	16	Im. ι Tauri,	4.5	90°	57°
	18	14	Em.		271	224
7	16	59	Im. ϵ Lextantis,	6	170	218
	17	34	Em.		237	281
17	8	38	Im. 2246 Bailey,	7	65	29
	9	43	Em.		256	211
22	6	26	Im. 16 Piscium,	6	54	95
	7	44	Em.		245	273
22	13	50	Im. m Piscium,	6	70	22
	14	53	Em.		245	195
26	6	47	Im. π Arietis,	5	118	170
	7	29	Em.		198	251
30	17	1	Im. ν Geminor,	5	130	93
	18	19	Em.		259	208

NOVEMBER.

3	14	5	Im. Bessel,	8	110°	145°
	15	18	Em.		293	325
4	14	9	Im. Lalande,	6	131	182
	15	7	Em.		273	322
4	16	52	Im. Bessel,	8	107	146
	18	7	Em.		311	335
5	13	11	Im. Bessel,	8	139	189
	13	57	Em.		262	312
5	13	11	Im. Bessel,	7	139	189
	13	57	Em.		262	312
6	15	11	Im. Bessel,	8	171	221
	15	41	Em.		234	284
13	5	36	Im. Lalande,	8	9	316
	6	8	Em.		341	283
13	6	46	Im. Lalande,	7.8	115	77
	7	32	Em.		209	165
14	8	39	Im. Lalande,	8	97	52
	9	31	Em.		220	171
15	5	58	Im. Bessel,	7	53	40
	7	15	Em.		252	224
16	5	24	Im. ϵ^1 Capricorni,	6	119	127
	6	5	Em.		192	189
18	8	32	Im. α^1 Piscium,	5.6	109	90
	9	24	Em.		188	156
29	8	41	N.App. 29 Cancr,	6		
			D S. δ^1 8			

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AND
AMERICAN REPERTORY.

NOVEMBER, 1844.

CIVIL ENGINEERING.

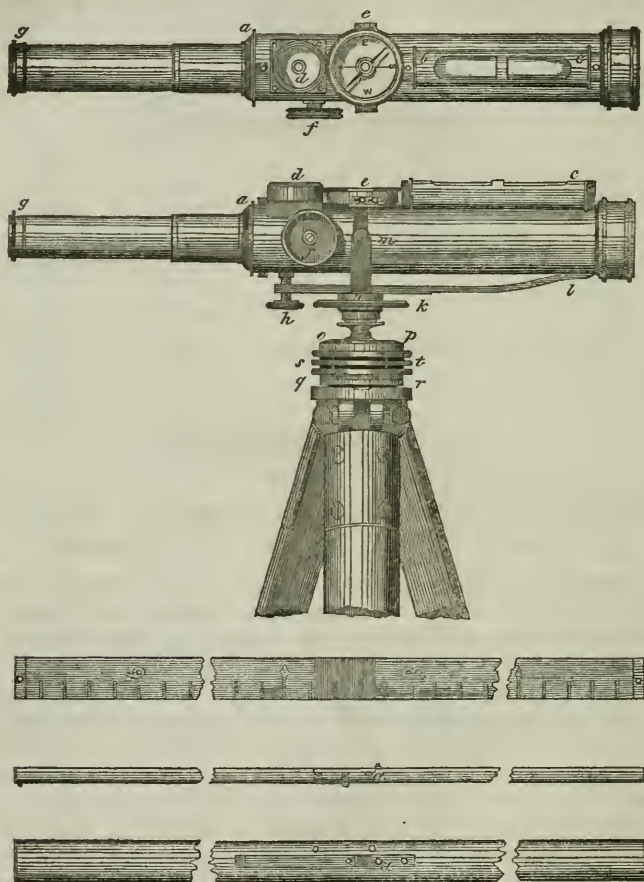
Description of Portable Leveling Instruments. By DAVID STEVENSON, F.R.S.E., F.R.S.S.A., C. E., Edinburgh.*

In examining a tract of country, I have often experienced the want of some portable, and, at the same time, accurate instrument, for ascertaining, in a general manner, the relative levels of different points, previous to determining the line of a more detailed survey. A small spirit-level without any telescope, having a common sight and cross-hair attached, is sometimes used for that purpose, being fixed on a staff stuck into the ground. The large instruments commonly used in leveling, are also often employed, but neither of these instruments answers the object I had in view; the first being much too rude for the required accuracy, and the second too heavy for easy transport. The level represented in the accompanying drawing, was designed to supply this want. It consists of an accurate spirit-level, a ten inch telescope, and a compass, so arranged as to admit of being very portable. The telescope unscrews at letter A, so as to form two compartments, and the whole is packed in a pocket case measuring 6 by 2 $\frac{3}{4}$ inches; and the tripod on which it stands does not exceed the bulk of a thick walking staff.

Referring to the drawing, B C is the level, D a circular level, E the compass, F screw for adjusting focus, G the eye piece, H screw acting

* Read before the Royal Scottish Society of Arts, 12th of February, 1844.

on spring K L, which is fixed to the telescope at M, by a crutch on which it moves, N the screw by which it is fixed to the tripod, O P Q R the top of the tripod, which contains a ball and socket joint, shown in dotted lines, which can be clamped and unclamped by means of a screw wrought on the inside of the part S T. In setting the instrument, the screw S T is first unclamped, and the instrument is moved by the hand on the ball and socket joint until the air bubble of the



level D, occupies the centre of the circular box containing it. The screw S T, is then clamped, and the instrument being directed to the object to be observed, the final and more perfect adjustment is made by bringing the air bubble B C, to occupy the centre of its tube, which is done by means of the screw H, which acts on the spring K L. The tripod is that used by Dolland for the camera lucida, and answers both instruments. The telescope can be made either, as in ordinary

levels, to reverse the objects, or, as in theodolites, to show them in their true positions. In this level, made for myself, I have adopted the latter construction, in order that the instrument may answer more perfectly the purposes of a field telescope. The addition of the compass is also a further convenience.

In connexion with this instrument, I have also had a portable leveling staff made, which also is shown in the engraving. It consists of an elliptically-moulded staff three feet three inches in length, and cut through the middle; the two halves are hinged at one extremity, and, when unfolded, are fixed by a spring at A, forming a rod six feet six inches long, on the flat side of which the graduations of feet and inches are painted; when closed, the graduation is protected from injury, and the whole forms a convenient walking staff.

These instruments, which were made for me by Messrs. Adie, of Edinburgh, I have found very convenient; and, I am persuaded, they will be suitable in all circumstances where the combination of *accuracy* and *portability* is required.

Edinburgh New Philos. Journ.

LIPSCOMBE'S Patent Apparatus for lessening the vibration and noise of Railway Wheels.

It is now generally understood that the rapid deterioration as regards the strength of railway wheels and axles, is chiefly caused by the intense vibration to which they are subjected. This can readily be made evident:—If the journal of an old railway axle is struck with a smith's hammer, it will, in many cases, break off with a single blow, presenting, at the fractured part, a weak, brittle appearance; whereas the journal of a new axle will take several hundred blows before breaking, a tough, fibrous appearance being presented at the fractured part. Suppose a finger to be in the act of creating a musical sound by laterally distending a harp string, it is plain, if the finger is taken away, the elasticity of the string will cause it to fly to and fro, until, from the friction of its fibres, the string is brought to a quiescent state. Now it is clear that the same effect would be produced by deflecting the harp string with a weight, and suddenly withdrawing that weight. We thus see, as the weight upon a wheel in motion is ever shifting, the particles composing a wheel are successively deflected every revolution, the weight shifting with a rapidity depending upon the speed of the wheel. It follows, as in the case of the harp string, that the deflected particles, immediately the weight is shifted, will begin and continue to vibrate until the wheel stops; the consequence is either the spokes become loose, thus rendering the wheel useless, or the particles of the wheel by being wedged and dove-tailed together, become, by this wriggling motion, so loosened and broken, as, in a few years, to render the wheel unsafe, consequently useless, from its great decrease of strength, although the actual quantity of metal in the wheel remains the same as ever.

The same remarks are applicable to railway axles.

The vibration which takes place in a wheel is communicated to the axle, as the axle is struck by the vibratory particles of the wheel. That this is exceedingly destructive to wheels and axles, is sufficiently attested by their great decrease of strength, and the pecuniary loss every railway company sustains from this cause, together with the accidents which have occurred by the breakage of axles.

Mr. Lipscombe, after a variety of experiments, ascertained that any metallic body could be prevented from vibrating, by simply pressing a quantity of sawdust, &c., in contact with it, so that when the particles of a body are deflected by a weight, their elasticity, when the weight is withdrawn, is spent in forcing back the sawdust, while resuming their original position.

An apparatus was constructed and applied to the wheels of a ballast wagon by way of experiment, and exceeded the most sanguine expectations formed of it. It completely prevented vibration, not only in the wheels, but in the axles; the noise of the wheels was very slight, the little noise produced being occasioned by passing over loose, or sunken, joints, and the wheels, as may be supposed, from the absence of vibration, had a very easy motion.

The patentee subsequently, through the recommendation of Mr. R. Stephenson, obtained permission of the directors of the London and Birmingham Railway, to apply his apparatus to one of their first class carriages. Previous to the wheels being placed under the carriage, one pair, with the apparatus applied, was slung off the ground, and struck in various parts of the axle and wheels, but not the slightest vibration could be detected. Another pair not fitted with the apparatus was afterwards slung in a similar manner, and when struck, produced a sound as loud and prolonged as a bell would have done. The carriage has been running daily with the trains for upwards of nine weeks, and is a great favorite for its peculiarly smooth motion, and comparative noiselessness, although, from being in a train with carriages before and behind it, the ears are assailed by their noise.

The apparatus is very simple, consisting of a plate of zinc placed on each side of a wheel, for the purpose of retaining sawdust, in contact with part of the rim and spokes; each plate has two wooden rings of unequal size, permanently fixed to it, the external diameter of the smaller ring, and the internal diameter of the larger ring, are shown by dotted circles in the annexed figure, and are likewise flush with the edges of the zinc plates. The combined depth of the corresponding rings is equal in



width to the tyre; these rings meet and are screwed together, certain parts of the rings being cut away to let in the spokes. By a reference to the figure, it will be seen that the ends of the spokes, adjoining the

nave and tyre, are left exposed for the purpose of noticing any defect which may take place in those parts.

The apparatus may be detached from the wheel, by simply taking out the screws which hold the corresponding rings together, and is applicable, with slight modifications, to all existing metal wheels. The cost of the apparatus is £1 per wheel, and it will last for many years.

Wheels formed of a combination of wood and iron are in partial use upon some railways, for the purpose of decreasing noise and vibration, which still exists, notwithstanding, to a very considerable extent. It must be recollected that all bodies are vibratory—the harder and more fibrous a body the more freely will it vibrate; therefore, it is utterly impossible to use any material tough enough to form part of a railway wheel but which will vibrate, and create considerable noise, unless a non-vibrating substance, such as sawdust, is placed in contact with it. The disadvantages and danger of railway wheels formed of a combination of wood and iron are well known to engineers, as far counterbalancing their slight decrease of vibration and noise.

There cannot be a doubt that an iron wheel prevented from vibrating, would be the safest, most durable, most economical, and the most noiseless, with a smoother motion, and less draught than any other description of wheel.

Lond. Mechanics' Mag.

The Atmospheric Railway.—Opinions of ROBERT STEVENSON, C. E., based upon his Experiments at Dalkey.

1st. That the atmospheric system is not an economical mode of transmitting power, and inferior in this respect both to locomotive engines and stationary engines with ropes.

2d. That it is not calculated practically to acquire and maintain higher velocities than are comprised in the present working of locomotive engines.

3d. That it would not, in the majority of instances, produce economy in the original construction of railways, and in many would most materially augment their cost.

4th. That on some short railways, where the traffic is large, admitting of trains of moderate weight, but requiring high velocities and frequent departures, and where the face of the country is such as to preclude the use of gradients suitable for locomotive engines, the atmospheric system would prove the most eligible.

5th. That on short lines of railway, say four, or five, miles in length, in the vicinity of large towns, where frequent and rapid communication is required between the termini alone, the atmospheric system might be advantageously applied.

6th. That on short lines, such as the Blackwall Railway, where the traffic is chiefly derived from intermediate points, requiring frequent stoppages between the termini, the atmospheric system is inap-

plicable; being much inferior to the plan of disconnecting the carriages from a rope, for the accommodation of the intermediate traffic.

7th. That on long lines of railway the requisites of a large traffic cannot be attained by so inflexible a system as the atmospheric, in which the efficient operation of the whole depends so completely upon the perfect performance of each individual section of the machinery.

Lond. Railway Mag.

New Mode of Tracking on Canals.

It will be interesting to our scientific readers to learn, that steam-tugs with screw propellers, have now been successfully introduced on the Union Canal. The boats are the first of the kind introduced into Scotland. They are built of iron, by Messrs. John Reid & Co., Port Glasgow, and the engines, screw propellers, &c., are fitted up by Mr. William Napier, Sr., engineer, Glasgow. The engines, which are much admired, are on the upright principle. They communicate their power to the screws, placed on one side of the bow; and by a very nice arrangement of wheels with wooden and iron teeth, (in order to prevent noise and vibration,) they are driven at a great speed without creating any of that surge, or wash, on the banks which has hitherto formed the chief objection to the use of steamers on canals. The steamboat tried a few days ago, had attached to her six very large scows deeply laden, but it is capable of towing double the number without material diminution of speed. The scows to be tracked are connected together by rods, having a parallel movement, and all under the control of the steersman on board the steamer, so that the necessity of a separate rudder and steersman for each scow is avoided—the whole train moving along with a steady and uniform motion.

Glasgow Citizen.

Level of the Caspian Sea.

The President read the note of a Russian operation for determining the actual depression of the Caspian Sea below the level of the Mediterranean—which operation had been reduced by the eminent astronomer M. Struve, now in England, and communicated by that gentleman to him. A few years ago, it was generally believed that the waters of the Caspian Sea were at least 300 feet below the level of those of the Black Sea and Mediterranean. This view was adopted in consequence of a series of barometrical observations; but, it having been found that from the great number of stations across the land separating the Caspian from the Sea of Azoff, small errors had become greatly magnified, a new survey was made. Three able mathematicians, Messrs. Fuss, Savitch, and Sabler, were, therefore, employed to make independent trigonometrical levelings, and their observations agreeing to within a foot, or two, give, for the mean result, 83.6 English feet as the depression, the possible error being limited to 1.3 foot, which definitively settles this long pending geographical question.

Lond. Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in March, 1844, with Remarks and Exemplifications. By CHARLES M. KELLER, *Examiner of Patents.*

1. For a manufacture of goods denominated *Corrugated, or Shurred, India Rubber Goods*; Charles Goodyear, city of New York, New York, March 9.

These goods are formed by cutting sheet India rubber into narrow strips, or threads, say of one-eighth, or one-sixteenth, of an inch in width, and usually of the thickness of a card. These strips are then stretched upon a suitable board, or table, in such manner as that they may pass back and forth parallel to each other, say at the distance apart of one-fourth of an inch, more or less. The table, or board, is provided with pins, or notches, at each end, and around these pins, or through the notches, the threads are to be stretched as they pass back and forth; the stretching of these strips may amount to twice their quiescent length. Whilst so stretched, two lamina of cloth, or of other suitable material, of the requisite width and length, which are covered on one side with moist India rubber cement, are to be placed one on each side of the stretched threads, the cemented sides being towards said threads; these lamina are to be brought into contact with each other between the threads, which may be readily done by passing a smooth piece of metal, ivory, or other article along the side of each of the threads.

Claim.—“What I claim as new, is the forming of such goods by the stretching of strips, or threads, of India rubber to such extent as may be desired, and the covering the said strips, or threads, on opposite sides with lamina of cloth, leather, or other suitable material, which lamina are to be united to each other, and to the threads, or strips, by means of India rubber cement, the same being effected so as to produce a manufactured article substantially as described.”

2. For a machine for manufacturing *Corrugated, or Shurred, Goods*; Charles Goodyear, city of New York, March 9.

This machine is for the purpose of making the kind of goods secured by the preceding patent, and consists of two calender rollers, geared together to insure their turning with equal velocity, and between which passes the stretched strips, or threads, of India rubber, and the two pieces of cloth, or other material, prepared as explained in the preceding patent. An endless belt of India rubber, or other elastic material passes around one of the calender rollers, and another, or stretching, roller back of it, for the purpose of pressing the two sheets of cloth together between the threads, or strips, of India rubber, and in this way the surfaces of the cloth, which are covered with cement, are made to adhere to each other, and to the strips of India rubber. Just above the calender rollers, there is a grooved roller to guide the

strips, or threads, of India rubber, and keep them at the required distance apart, and for the purpose of keeping them stretched they are attached to a sliding frame which moves towards the calender rollers, with a velocity equal to that of the periphery of the rollers.

Claim.—“To the construction of the parts of the machine I do not make any claim, nor do I claim the use of the calender rollers, similar rollers having been employed in the manufacturing of India rubber goods, and for other purposes; but what I do claim as new in the above described machine, and wish to secure by letters patent, is the combining with the calender rollers an elastic endless apron, and a stretching frame, with its appurtenances, for the purpose of giving and preserving to the strips, or threads, their proper tension, and allowing them to pass between the lamina of coated cloth, or other material, so as to produce the corrugated, or shurred, goods, as set forth.”

3. For an improved method of *Lining Metal Boxes of Carriage Wheel Hubs*; Moses Palmer, Baltimore, Maryland, March 9.

This is for lining the metal box with leather by cutting, or casting, a groove inside of the box, along its whole length, to receive and hold the edges of the leather lining. At one end this groove passes entirely through the thickness of the metal of the box to secure the leather by means of rivets, or other analogous devices.

Claim.—“What I claim as new, is the combining of a lining of leather, or of hide, with a metallic box intended to be inserted in the hub, or nave, of a carriage wheel; such lining being secured in place and combined with the metal substantially in the manner set forth, and made known.”

4. For an improvement in the *Press*, applicable to the lifting of heavy weights; Smith Cram, city of New York, March 9.

This patent is granted for improvements on a machine patented by George Kilburn, on the 23d of August, 1838, and noticed at page 93, of the twenty-fourth volume of this Journal, to which the reader is referred for a general description of the principle.

We are under the necessity of omitting the claim, as it refers to, and is so much dependent upon the drawings, that it could not be understood without them, and the general importance of the invention, in view of the difficult and complex character of the drawings, does not call for their publication at this time.

5. For an improvement in the *Plough*; Israel Long, Bucyrus, Crawford county, Ohio, March 9.

Ploughs have long since been made with a wheel between the land side and the mould board, for the purpose of supporting the weight of the back part of the plough, and avoid a portion of the friction which wears away the heel of the plough. The improvement in question is for making this wheel adjustable by attaching its axle to

a bar jointed to a protection from the inside of the land side, and mould boards, and regulating it with a suspension screw rod.

Claim.—“I do not claim as new inserting a wheel for the purpose of relieving the heel of the land side and mould board of friction, as that has been done, but what I do claim as my invention, and desire to secure by letters patent, is the combination of the roller with the plough, in the manner described, by means of the jointed bar and rod, so as to render it adjustable.”

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6. For an improvement in the *Cotton Press*; George Peck, Fairfield, Connecticut, March 9.

This is for an improvement in a press previously patented, but which has not yet been noticed in this Journal, in consequence of the hiatus in this list, which we hope to close up very soon.

The action of this press is upwards, and to the under part of the follower two rods, called “levers,” are jointed, the other ends of which rods are provided with rollers that run on rails on a horizontal platform. Blocks, or pulleys, are attached to the lower ends of these rods, provided with appropriate cords, or chains, that wind around a windlass midway between the rods, or levers, for the purpose of drawing them towards each other, and thus cause them to act in the manner of a double toggle joint lever in forcing up the platten or follower, of the press, the platform taking the place of the lower arms of the toggles. Such is the press previously known, and the improvement in question is for the purpose of drawing out the rods, or levers, and drawing down the platten, which is effected by means of two springs on each side, one extending from the lower end of each rod, or lever, passing over the end of an arm jointed to and projecting from the side of the frame, and then extending up to the end of another spring projecting out horizontally from the upper part of the press frame.

Claim.—“I make no claim to the combined levers and follower, nor to the apparatus for drawing them together in pressing; but what I do claim as my invention, is the combination of the springs and levers for drawing down the follower, in the manner set forth.”

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7. For an improvement in *Lamps*; Samuel Rust, city of New York, March 9.

This is for an improvement in hand and other lamps, in which the wick is raised by means of a roller, and the object is to insure the raising of the wick by the roller, which it does not always do as heretofore arranged, and to facilitate the introduction of the wick. These two objects are attained by attaching a spring to the wick tube which extends up through a hole, or recess, in the cap, made sufficiently large to give it ample play. The upper end of the spring is provided with a thumb piece, by which it can be pressed towards, or drawn from, the roller.

Claim.—“What I claim is a thumb piece, press, or slide, to manage the wick by, pressing the thumb piece, press, or slide, against the wick, or wick raiser, with the finger, or thumb, or relieving the

pressure from the wick, or wick raiser, combined with the roller, or any other wick raiser, analogous to the roller; and also the recess, or opening, in the tube, or stopper, combined with either the spring thumb piece, press, or slide, as above set forth, or in any other way which is essentially the same."

8. For an improvement in the *Mill for Grinding Grain*; Erastus Arnold, Otsego, Otsego county, New York, March 9.

We have here an improvement in that kind of mills in which the faces of the grinders are vertical, and the nature of this improvement will be fully understood by reference to the following—

Claim.—"What I claim as my invention, is the method described of constituting the permanent, or bed, grinder, by covering only a portion of the surface with teeth, and feeding in the grain at the commencement of this grinding surface, and discharging the meal at the other, instead of grinding over the whole surface, as described."

9. For improvements in machinery for *Folding and Measuring Cloth*; Silas C. Durgin, North Chelmsford, Middlesex county, Massachusetts, March 9.

This patent is granted for improvements on a machine patented by Joel Spalding, on the 28th of August, 1841, noticed at page 275 of volume iv, 3d series, of this Journal, to which the reader is referred.

The first improvement claimed is for an arrangement of parts by which the folders are elevated and depressed. The second improvement is for an arrangement of endless bands, (with their pulleys and shafts,) and a cross bar in combination with the bar that depresses the cloth, for introducing the cloth, and overlapping the first fold produced. The third improvement is for the method of feeding the cloth into the machine, so as to present it to the action of the folders as required by them, and with little or no strain upon them, by supporting the cloth on one or more horizontal rods, or shafts, (placed above the folders,) in combination with giving to the surface of the feed roller a motion sufficiently increased, beyond that of the folders, to cause that part of the cloth which is between the supporting rod, or rods, and the feed roller, to be loose, or hang down in proper quantity to readily yield to the irregular motion of the folders over the platform caused by the cranks of the shafts which operate the sweeps of the said folders.

We are under the necessity of omitting portions of the first and second sections of the claim, because of their reference to, and dependence upon, the drawings, but the substance has been given.

10. For an improvement in *Cooking Stoves*; Samuel Bentz, Boonsboro', Washington county, Maryland, March 9.

This patent is for the addition of what is called a "pastry oven," below the principal baking oven; it is placed below the bottom plate of a stove, in which there is a flue space between the bottom of the

principal baking oven, and the bottom plate of the stove, and it has a flue surrounding it on four sides. There is a partition in the middle of this bottom flue space with holes, provided with a register, to allow the draught to pass directly around the principal oven, or through a hole in the bottom plate of the stove, around the pastry oven, and out through another hole in the bottom plate beyond the before mentioned partition—the two holes in the bottom plate being also governed by a register.

The claim is limited to the arrangement of the flues, in combination with the pastry oven, and sliding registers.

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11. For an improvement in the *Buckle*; Isaac B. Verplank, Mentz, Cayuga county, New York, March 9.

The object of this improvement is to avoid the necessity of weakening the strap to be held, or fastened, by making holes through it to receive the points. The buckle frame, or case, is composed of two side pieces, and two cross bars at top, one at each end, and a bottom plate extending from one end to about the middle, and midway between this bottom plate and the end of the case, a lever is jointed, by means of a fulcrum pin, which passes through the sides of the case, and a hole in the middle of the lever. One of the straps is secured by sewing, or otherwise, to a flat loop in one end of the lever, and the other strap, or the other end of the same strap, as the case may be, is passed in between the bottom plate and one of the cross pieces, then over the inner end of the lever, and then under the other cross piece at the other end. The tension of the strap causes it to be held and gripped between the cross pieces of the case, and the ends of the lever.

Claim.—“What I claim as my invention, is the combination of the buckle case, consisting of the bottom, sides, and cross pieces with the lever, containing an aperture at the end, and one near the middle, the whole being constructed and operating in the manner and for the purpose described, or in any other substantially the same.”

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12. For an improvement in the *Washing Machine*; Ephraim Lukens, Baltimore, Maryland, March 9.

The nature of this improvement consists in suspending a perforated swing board between the ordinary vibrating presser, and the back of the wash tub, against which the clothes are pressed, and through which the water passes to the space behind it, which water, when the presser is withdrawn, or carried to the front of the tub, by its gravity, rushes under its lower edge, and through the apertures in the swing board, strikes against the clothes, turns them over, and again percolates through them—the motion of the said swing board, when the presser board is withdrawn, also assisting in turning the clothes over in the water in the tub.

Claim.—“What I claim as my invention is combining a perforated swing board with a vibrating pressing board of machines for washing clothes, whether in the manner here described, or in any other mode,

or way, which is substantially the same, and wherein analogous results are produced."

13. For an improvement in the mode of *Setting Kettles*, for evaporating saccharine juices, in the manufacture of sugar; Abraham Hager, Donaldsonville, Parish of Ascension, Louisiana, March 9.

The first improvement claimed is the use of spiral descending flues under the grandes, or clarifying kettles, the said flues being governed by a valve which is made hollow, and filled with water, and which is made the subject of the second improvement claimed under the patent; and the third improvement is for an arrangement of flues in combination with the form of the bottom of the granulating kettle, which is concave on the under surface. The flues are formed to correspond with the bottom of the kettle, and provided with a partition, for the purpose of preventing the heat from passing to the chimney before it has circulated around and under the surface of the concave bottom of the kettle, whose lower edges rest on the brick seat, or bed, except at a place near the partition, where a space is left open for the draught to pass under the edge of the kettle to the flue formed around the outside of the kettle.

14. For an improvement in the mode of making the *Mould Board of Ploughs*; Harvey Brown, Payson, Adams county, Illinois, March 9.

This mould board is made of a plate in the form of a rhombus, with a curved and angular projection on two of the parallel sides, which are bent back at the requisite angle—the curved projections being for the purpose of receiving a bar by which the mould board is secured to the standard, so that it can be reversed to use either of the two edges for a share, and the angular projections answer the purpose of land sides. In the specification and drawings, several of these mould boards are described, and represented as arranged in a frame to form a gang of ploughs.

Claim.—“What I claim as my invention, is constructing the plough in the manner described; that is to say, constructing and arranging the projections upon the mould board, so that the plough may be used either side up, whether it be a right, or a left, plough. I do not claim combining a number of ploughs, and attaching them to a frame.”

15. For improvements in machinery for manufacturing *Lead Pipes*; Charles and George Escol Sellers; Cincinnati, Ohio, March 9.

“In manufacturing lead pipes by this process, the metal from which it is to be formed is fused, and poured into a receiver of cast-iron, or other metal of great strength, which receiver is heated by means of a suitable furnace, so as to preserve the metal in a fluid state. The lower part of the receiver contains a die, having an opening through it of such size as to adapt it to the forming of the outside of the pipe,

and a case, or mandrel, to determine its size, or calibre, within. It also inclosed the apparatus which is employed for the purpose of cooling the pipe as it leaves the core, and also of keeping the temperature of the core below that of melted lead, by which means we effectually prevent the combining of the lead with the surface of the core, which takes place when lead is in a fused state, and is subjected to heavy pressure. The fused lead is to be forced out by means of a ram, or plunger, made to fit the cylindrical cavity containing the lead, said plunger being brought down by means of an hydrostatic press.

Claim.—“We do hereby declare that we do not claim any of the parts of the said machinery when taken separately, with the exception of those hereinafter particularly pointed out; nor do we claim the use of the hydrostatic press, for applying the force required in the formation of the pipe; nor the use of conical dies for forming its exterior, or of a mandrel for forming its interior; nor the bridge by which said mandrel is sustained, these having been long since used, and being described in the specifications of patents obtained in England and elsewhere, and having, therefore, become public property; nor do we claim the manufacturing, or forming, of lead pipe from lead kept in a molten state whilst it is kept in the cylindrical cavity, which we have called the receiver, and also when it passes the bridge, and arrives at the conical die, and the part of the mandrel which said die surrounds, this having been before done by us, and by others; but what we do claim as our invention, is the employment of a tubular core, or mandrel, divided longitudinally into chambers, through which heated water, air, or steam, is to be passed, in the manner described, and for the purpose of preserving said core at a temperature somewhat below that of melted lead; by which device the lead is effectually prevented from adhering to the mandrel. We claim the manner of forming the packing of the ram, by attaching to its end the piece of wrought-iron rendered thin at its lower edge by forming the face of the said piece concave, for the purpose above set forth.”—[The purpose here alluded to is keeping the piston tight, and preventing the escape of the melted lead around the edges of the ram, or piston.] “We claim the combination and arrangement of the parts constituting the water chamber, consisting of the tube, the bed piece, and the conical die; the supply of water thereto being given, and governed substantially as described.”

16. For an improvement in the *Spiral Submerged Propeller, for steam-ships, &c.*; Ralph Bulkley, New York city, March 13.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is giving to the inclined, or spiral, paddles an inclination from the radius, for the purpose and in the manner specified.”

We deem any explanation unnecessary, as the claim points out distinctly what the improvement is.

17. For an improvement in the machine for *Pressing Hats and Bonnets*; Caleb Merritt, Baltimore, Maryland, March 13.

The shaft on which the hat block is placed, has its bearings in a segment piece jointed to the frame, for the purpose of giving to the block any desired inclination, which is effected by a pinion that takes into cogs on the periphery of the segment piece. The hat block is provided with a mitre cog-wheel which gears into another mitre wheel on the pin that forms the centre of motion of the segment piece, that the wheels may continue in gear through the whole extent of the vibration of the segment piece with the hat block. The last named mitre wheel gears with another cog-wheel on the shaft of a ratchet wheel, the band of which is operated by a series of levers in connexion with a rock shaft, actuated by the shaft, or rod, that carries the pressing iron, and which is worked by the operator—the end opposite the handle being connected by means of a universal joint, and a slide with a gate, or frame, attached to a long arm projecting from the rocking shaft. By this arrangement the pressing iron being midway between the handle part of the shaft and its connexion with the gate, the pressing of the iron on to the hat by the operator communicates motion to the whole combination above described, and causes the block to turn with the hat on it.

Claim.—“What I claim as my invention, is the combination of the shaft which carries the pressing iron with the gate by means of the slide and universal joint, as described; and these, thus combined, I claim in combination with the rock shaft, which communicates motion to the shaft of the hat block, by the action given to the shaft which carries the pressing iron. I also claim the segment piece which carries the shaft of the hat block, and which is shifted by the pinion, in combination with the mitre wheels, &c., for the purpose and in the manner described.”

18. For an apparatus for *gathering Fruit*; Alexander McWilliams, Washington, District of Columbia, March 13.

To a disk on the end of a handle of any required length, there are four wires that project a few inches with loops at their ends; to one of these loops a cord is attached, and then carried through the loops on the other wires, and back to, and through, the first, and then passes down the handle. There are other wires placed around the disk to prevent the fruit, after being separated from the tree, from falling out. The cup formed of these wires is passed around the fruit, and then the cord pulled, which draws the upper ends of the four wires together, and enables the person using the apparatus to separate the fruit from the tree.

Claim.—“What I claim as my invention, is the combination of the grasping wires and string, with a handle of any convenient form, for the purpose of grasping objects which cannot be conveniently reached by the hand, the construction and operation being substantially as described.”

19. For an improvement in the mill for *grinding Grain*; Eli B. Nichols, and David Marsh, Fairfield, Connecticut, March 13.

Claim.—“We claim the mode of sustaining the runner stone upon the still spindle, by the bale, through the chuck; and the combination of these parts with the forked cylinder in the lower end of the driving spindle, to furnish a means of driving the spindle and runner stone from above.”

The dead spindle passes up through the bed stone, and has a countersink, in its upper end, to receive a point projecting from the under part of the chuck, which is grooved out around the point to receive the upper end of the dead spindle. The under side of the bale, which is attached to the eye of the runner, has also a point which rests in a countersink in the upper surface of the chuck, to balance the runner, and the upper part of this bale is adapted to receive the forked end of the driving spindle.

20. For a machine for giving *Exercise to Dyspeptics and other Invalids*; Oliver Halsted, New York city, March 13.

The patentee says,—“The nature of my invention consists in giving to a seat, upon which the patient is placed, an exercise similar to that given to the rider on a horse, with this difference, that, in the absence of all effort, on the part of the patient, to retain his seat upon the chair of exercise, (which absence of effort is not obtained on horse back,) he may relax the abdominal muscles, which is indispensable in order to stimulate the muscular coat of the stomach, and, at the same time, restore the peristaltic motion of the bowels, so that both secure their healthy action.”

The seat may be attached, by means of a slide, to one end of a working beam, vibrated by means of a crank, eccentric, or cam, actuated by any first mover; or a seat may be attached by the same means to a car, the axle of one of the sets of wheels being cranked to vibrate the beam, and two of these cars may be attached to the opposite ends of a sweep, in the manner of what are well known as flying horses. There are various modifications described and represented.

Claim.—“What I claim as my invention, is the giving of an undulating, or jolting, motion to a chair by means substantially as herein described, for the purpose of curative treatment of dyspeptics, and other invalids, and for healthful exercise. I do not mean to confine myself to the precise form of construction of the individual parts, but vary them as I may have occasion, without departing from the general principles of action herein set forth, to wit, the giving of an undulating, or jolting, motion to a chair in contradistinction to a rocking, or oscillating, movement of the same, of which several examples of such variations are represented and specified.”

21. For an instrument, or pattern, for *Cutting Boots*; Thomas Cranage, Warren, Trumbull county, Ohio, March 13.

Claim.—“I do not claim the extension of a pattern by sliding one piece upon another, fastened together by nuts and screws; but what I do claim as my invention, is the combination of the slides with the plates having graduated scales thereon, in the way described, the

whole being constructed and arranged in the manner and for the purpose set forth."

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22. For an improvement in the *Rake for gathering Grain*; Benoni P. Patridge, Onondaga, New York, March 13.

The "handle, or stale, is formed of a stick of natural, or artificial, bend, commencing at the head of the rake, with a slight curvature, and gradually increasing about two feet, where the bend is increased to near a quarter circle, thence for about two feet with a very slight bend upwards, where it is suddenly bent so as to have the extreme end of the stale in nearly a perpendicular position, affording an easy hold for the upper hand of the operator, whilst his lower hand is on a double thole about two feet from the head of the rake, and by which he draws the instrument forward. The object of the double thole is to enable the operator to work on either side of the rake."

Claim.—"What I claim as my invention, is the combination of a grain rake of the above described construction, with a curved handle—said handle being curved in the manner set forth, or any other substantially the same, in which the operation would not be changed, the whole operating as set forth."

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23. For an improvement in the machine for making *Brooms*; Jacob H. Hinton, Lancaster, Penna., March 13.

The bundles of broom corn for two brooms, are put into boxes on a carriage, to be presented to the wrappers, and pressed down by a presser, or brake, which is held down by a hook, and then presented to the wrappers, which are somewhat like the flyer of a spinning machine, the twine being passed through the shaft, and then through the hollow arm that carries it, and wraps it around the bundle of corn, the brake being first removed, and the carriage having a movement from the wrappers by means of a screw, to lay the twine regularly.

Claim.—"What I claim as my invention, is the combination of the rests, or pedestals, pressers, and brake, for pressing and holding the broom corn. I also claim the combination of the brake on the carriage, for holding the broom corn, in combination with the wrappers, as set forth."

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24. For an improved mode of *Fastening the Check, Pad, or Water Hook, of the Pad, or Saddle, of a Harness*; Abel B. Buell, Westmoreland, Oneida county, New York, March 13.

This is for fastening the check hook to the pad, or saddle, by a dove-tail turning joint, instead of riveting, as heretofore. The stem of the hook has flanches, and that part of the pad to which it is to be attached, has a hole, one part of which is sufficiently large to permit the flanches to pass through, and the other of the width of the stem above the flanches, so that after the flanches have been put in, and pushed under, and the hole through which they were introduced closed up, the hook is retained in place without rivets, or screws.

Claim.—“What I claim as my invention, is the manner of fastening and securing the check hook and loop for the back strap, and for nothing else.”

25. For an improved mode of inserting *Artificial Teeth*; J. Smith Dodge, New York city, March 13.

Claim.—“What I claim as my invention, is the mode described for inserting artificial teeth, that is to say, by inclosing a metallic tube within the wooden plug, or cylinder, commonly employed in fixing artificial teeth, the wood and metal being both inserted in the stump, or root, substantially in the manner described, the said metallic cylinder constituting the socket for the pivot.”

The pivot attached to the artificial tooth is of metal, and is received in the metallic cylinder in the wooden plug inserted in the stump of the natural tooth.

26. For a *Label for Mail Bags, &c.*; Oren S. North, New Britain, Hartford county, Connecticut, March 13.

Instead of having two separate labels for a mail bag used to transmit letters back and forth between two places, say Boston and New York, these two labels are connected together by a joint, so that the names on either one of these labels can be put outside, and the other concealed.”

Claim.—“What I claim is uniting two labels by a joint, for the purpose described, using, therefor, the double hinge joint, or any of the known modes of effecting the same end.”

27. For an improvement in the machine for *Brushing and Winding Cloth*; Reuben C. Varnel, West Somers, West Chester county, New York, March 13.

Claim.—“What I claim as my invention, is the combination of the revolving cylinder of brooms with the weighted roller, adjustable roller, and revolving winding board, as described, for brushing and winding cloth, whether combined and arranged in the manner herein described, or in any other manner substantially the same, by which analogous results are produced.”

The rollers are for the purpose of passing the cloth in a distended state under the board, and as the winding board is known to all who are acquainted with manufactures, we need not describe it.

28. For an improvement in the mode of regulating the *Burning of Alcohol, or other inflammable liquids*, when used for vapor bathing, and other purposes; Lucien E. Hicks, Middletown, Connecticut; assigned to Giles L. F. Griswold, March 16.

This apparatus consists of a circular vessel, the cover of which, within the rim, is curved upwards, and then down with a short cylindrical tube of one-third its diameter, rising from the middle, and having small apertures to admit the inflammable matter from the pan,

or reservoir, to be ignited therein, and a turning disk valve to regulate the intensity of the combustion. A perforated ring for admitting air is placed on top of this pan, and above the ring is placed the vessel containing the medicated materials to be evaporated, and over this a cover, with a small pipe and holes, to conduct off the vapor. The person who is to receive the vapor is placed on a stool above this apparatus, and properly surrounded, as is well known to all who have taken vapor baths.

Claim.—“What I claim as my improvement, is the method of regulating the burning of alcohol, or other inflammable liquids, by means of the application of apertures and valves, as above set forth and described, when applied to vapor bathing, or other purposes, separately, and also in combination with a chamber, or reservoir, for holding the inflammable liquid that is to be conducted and burned at the apertures, and gradually supplying the same therewith during the process of combustion, constructed and operating as above described, so as to prevent ignition.”

29. For an improvement in the *Cotton Press*; Seth Lamb, New York city, March 16.

This is for improvements on a press, patented to the same person on the 12th of May, 1843, and which will be noticed as soon as we can bring up the arrears of this list of patents, and, therefore, the claims only of the improvements will be inserted at present, as the notice and description of the original invention will explain the whole.

Claim.—“What I claim as my invention, is the combination of the palls and racks with the foot block of a press constructed and arranged in the manner described. I also claim, in combination with the movable foot block, the segment and lever by which it is connected with the main lever, in the manner described. I lastly claim the employment of the pulley bed on which the bale rests, constructed and arranged as before described, so that it shall remain in its position until the bale is pressed, when it falls out of the way until the bale is tied, and the lever connected with the head block starts back.”

30. For an improvement in the *Harpoon for taking Fish*; Albert Moor, Hampden, Penobscot county, Maine, March 16.

This invention consists in jointing the fluke to the stem of the harpoon, and putting a vial of explosive mixture in a hole in the fluke, so located that on the opening of the fluke the vial is broken, and the mixture exploded. After the vial has been put in, the fluke is closed and secured by a wooden pin, and after the harpoon has been forced into a fish, the pull opens the fluke, and causes the explosion to take place within the fish.

Claim —“What the subscriber claims as his invention, is placing in the fluke of said harpoon, a vial of explosive mixture, of whatever materials, or ingredients, it may be composed, for the purpose and in the manner described.”

31. For an improvement in the *Portable Furnace*; George E. War-
ing, Stamford, Fairfield county, Conn., March 16.

The patentee says,—“My portable furnace I make of cast-iron, and in its general construction it resembles such as have been heretofore made. My improvement consists in the combining with the body of the furnace either a rotary, or a stationary, rim, so formed as in conjunction with the shape given to the upper edge of the body of the furnace, to constitute a flue space, the opening into which is through what I call the collar part of the rim; although this rim may be made stationary, I prefer, in all cases, to make it rotate, and shall describe it as being capable of doing so. By means of this device the heated air from the burning fuel is made to pass around the above named flue space before it is conducted off, and the heat is thereby much economized.”

Claim.—“What I claim as new in this furnace, is the forming of a flue space around its upper edge, by a projection from the body of the furnace, in conjunction with the rim, or in any other manner that is substantially the same; and this I claim whether the rim be made to rotate in the manner described, or whether it be permanently fixed with the opening towards the front of the furnace.”

32. For improvements in *Stoves for Cooking and Heating and Ventilating Buildings*; John Woolley, Springfield, Hampden county, Massachusetts, March 16.

A double case surrounds a stove of ordinary construction, the inner part of the double case being so much larger than the stove, as to form an oven with shelves, through which the pipe of the stove passes, and from which it extends to the top of the house, and there is a hole from the oven into the pipe for conducting off the fumes, vapor, &c., from the cooking. The door to the oven is double as well as the rest of the case which surrounds the oven, and the space between the inner and outer cases, and the double door, are provided with holes at the bottom to admit air from the room, which, after being heated, passes into a space between the smoke pipe and an outer pipe which surrounds the smoke pipe, and which also extends above the roof of the house, where a cap covers both of them for the purpose of increasing the draught. This outer pipe is provided with branch pipes for conducting the heated air into different apartments, and above these branch pipes there is a box and valves for preventing, or permitting, the escape of heated air from the space in the case.

Claim.—“What I claim as my invention, is the combination of the case and stove in the manner described, the pipe of the stove passing up through the centre of the case, and having a hole therein for the purpose set forth. I also claim carrying the two pipes out above the roof together, and covering them both with a cap, constructed, combined, and arranged in the manner and for the purpose set forth. Lastly, I claim, in combination with the above, the valve box and valves near the top of the house, for closing the outer pipes.”

33. For improvements in the method of *Suspending and Working Lock-Gates for Canals*; Henry McCarty, Pittsburgh, Pennsylvania, March 16.

Instead of supporting the gate on a railway at the bottom of the lock, it is balanced by means of a stirrup jointed to the outer edge of the gate, and to a rod by means of a swivel and screw for adjustment, the rod being jointed to the top of a post sustained by hog chains; and for the purpose of opening and closing the gate there is a triangular lever jointed to the gate at both ends, the third angle of this lever being provided with a roller that runs on a circular railway, equal, in radius, to the sweep of the gate, (the lever being an equilateral triangle,) and placed on the embankment of the lock. A chain is attached to the outer end of the gate, passed around a pulley and windlas on the embankment, and then made fast to that angle of the lever which runs on the railway.

Claim.—“What I claim as my invention, is the before described mode of suspending, and opening, and closing gates for locks, and other places, by means of the aforesaid combination and arrangement of the inclined post, rod, swivel, stirrup, and hog chains; and the triangular lever, segment way, cord, pulleys, and windlas by which the expense of construction is reduced, and the old railway and rollers at the bottom of the lock, and the chains for opening and closing the gates placed in the water, where they are subjected to constant oxidation, and where they cannot be reached without much difficulty when out of order, are entirely dispensed with.”

34. For an improvement in the method of applying *Circular Saws to the sawing of large timbers*; John K. Mayo, Orrington, Penobscot county, Maine, March 20.

We refer the readers to the claim, which is sufficiently explicit to convey a clear idea of the improvement patented.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the combination of two, or more, circular saws, every preceding one of less diameter than the next following one, their respective axes being on a common level, or two sets, or series, of saws of that description, one above the other, for the purpose of sawing together in the same scarf, lumber, &c., in an easier and better manner than heretofore done, the whole being constructed and operating as herein above set forth. I do not claim the application of two saws only, one above the other, for the purpose of sawing together in the same scarf.”

35. For an improvement in the machine for *Cutting Shingles, &c.*; William Wood, Westport, Connecticut, March 20.

This is for an arrangement of parts for moving the carriage which carries the block to the knife, by the motion of the knife gate, which has a reciprocating movement up and down. A rack on the side of the gate takes into the teeth of a pinion on a shaft provided with a

crank that communicates a reciprocal movement up and down to a slide, the upper end of which has a cross head with a horizontal slot in it, a little longer than the length of movement of the carriage. This slot receives the wrist of a crank on the end of a shaft provided with appropriate cams for feeding the block to the knife in such manner as to cut the butt of the shingles alternately from opposite ends of the block.

Claim.—“What I claim as my invention, is the combination and arrangement of the head block with the shaft, cams, carriage, and cross head, rack and pinion, arranged in the manner, (or that which is substantially the same,) and for the purposes set forth and described.”

36. For an improvement in *Door Plates*; John H. Grout, and Fowler M. Ray, New York city, March 20.

This improvement is for the purpose of rendering door plates visible by day and night. A hole of the requisite size is cut in the door, a plate of glass is put on the outside, within that another plate of glass with the name, or direction, painted on it, and back of this a reflector is hinged, which, by means of a button, can be brought up parallel with the glass plates to answer as a back ground for the day, or thrown down horizontally and at right angles, or more, to answer as a reflector for the night, there being a corresponding mirror above, and a plate of ground glass covering the opening on the inside of the door. The rays of light from a lamp within pass through the ground glass, and are reflected on the lettered glass.

Claim.—“What we claim as our invention, is the particular manner in which we have combined the reflectors with the device of a night door plate, as described—the distinctness of the lettering of the same being brightened by the illuminated light reflected by the mirrors by day, or night.”

37. For an improvement in the machine for *Thrashing and Cleaning Grain*; Luther Whitman, and Ezra Whitman, jr., Winthrop, Kennebec county, Maine, March 20.

For an explanation of this improvement, we refer to the following claim, viz.,—“What we claim as new, is the manner in which we have combined the vibrating screen with the machine, by placing it between the concave of the thrashing apparatus, and the endless belt of revolving slats, and below the conveying cylinder, so as to operate in the manner and for the purpose set forth; we do not claim any other part of the apparatus as of our own.”

38. For an improvement in the *Truss for the cure, or relief, of Inguinal Hernia*; David Sabins, Lancaster, Penna., March 20.

Claim.—“What I claim as new, is the manner set forth of connecting the pad, or pads, to the principal spring, by means of a double jointed link, contained within a cavity on the back part of the pad,

arranged and operating as described and represented. I also claim, in combination therewith, the manner of adjusting the pressure of the pad by the aid of the regulating bridge piece, by means of which the link may be made to bear on either side of the centre of the pad, or pads, as may be requisite."

39. For an improvement in the machine for *Cleaning Grain*; James M. Clarke, Strasburg, Lancaster county, Penna., March 20.

This is for an alleged improvement on that kind of smut machines which have the beaters attached to a vertical shaft working within a vertical cylinder, and a fan attached to the beater shaft below the beaters. The beating part of this machine consists of a hollow metallic cylinder, with valves attached to the inner periphery, converging towards the centre, and extending to within a short distance of the shaft, and with beaters attached to the outer periphery tangential to a circle smaller than the cylinder, and shielding apertures made in the cylinder between the junctions of the beaters and valves with the cylinder.

The fan and cylinder of beaters, are separated by a part of the casing, which also surrounds the beater cylinder and fan. The grain is conducted by a spout, at one side, from the hopper to the upper part of the casing which surrounds the beaters, and discharges into a spout at the opposite side, which extends from the fan case to the top of the machine for the discharge of foreign matter, and below the fan case for the delivery of the cleaned grain. There is also another spout extending from the fan case to the spout, which conducts the grain to the beater cylinder.

Claim.—"I do not claim in the above described machine, making an outward blast by internal fans, as that has been done, but in a cylinder different from mine; but what I claim as my invention, and desire to secure by letters patent, is constructing the cylinder in the manner described, with valves on the inside, creating a blast outward through apertures made therein, as above described, and shielding said apertures by inclined beaters, as before specified, and reversing the same on the shaft. I also claim the combination of the vertical spouts with the fan, in the manner and for the purpose herein set forth, and constructed substantially as described."

40. For an improvement in *Lamp Caps*; Francis Draper, East Cambridge, Middlesex county, Mass., March 20.

This is "for the purpose of preventing the oil that rises through the air tube, or otherwise, from running over and down the exterior of the lamp, by extending the perimeter of the cap upwards around the wick tubes to a proper height to form a deep cup, the sides, or rim, of the cup being bent, or curved, in, towards the wick tubes, in any manner to hold the oil. The screw plate of the wick tubes forming the bottom of this cup."

Claim.—"I claim forming an oil cup about the wick tubes, and above the top of the plate of the same, by extending the perimeter,

or exterior, rim of the cap upwards, as herein before specified, and for the purpose herein above set forth, thereby superceding the use of a screw in such place, as will allow the oil to get to the outside of the lamp."

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41. For improvements in *Kitchen Ranges and Grates*; Ambrose W. Thompson, Philadelphia, Penna., March 20.

This improvement is for a mode of altering, at pleasure, the capacity of the fire chamber, by making a recess at the bottom of the fire back, to receive and permit the bottom bars and back rail of the grate to slide in and out, and making notches in the upper edges of the cheeks, or jambs, of the fire chamber, to receive projections from the ends of the upper front bar of the grate.

Claim.—"What I claim as new, is the manner described of altering the capacity of the fire chamber of my improved range, by forming notches in the upper ends of the cheeks, and recesses under the fire back. I do not claim the altering the capacity of such a fire chamber, abstractedly, but limit my claim to the manner of doing this, as herein made known."

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42. For an improvement on Nelson Johnson's *Water-Wheel*; Hiram Ferguson, Richland, Oswego county, New York, March 20.

The claim in this patent is limited to an alleged improvement on a water-wheel patented by Nelson Johnson, on the 30th of May, 1838, and noticed in this Journal at page 243, of the twenty-third volume, and as it consists simply of a change of form in the buckets, we will simply refer the reader to the notice of the above named patent, and to the following claim:—

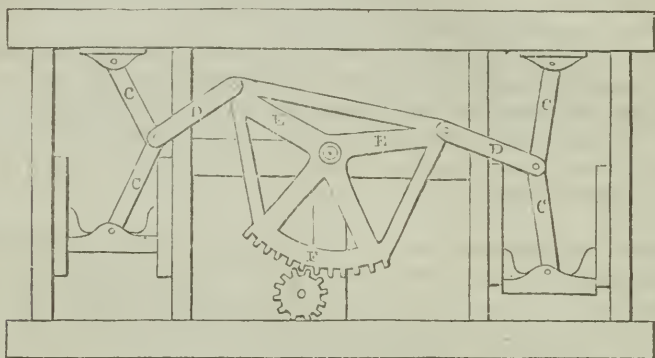
"I do not claim the gradually enlarged buckets, as used in Nelson Johnson's water-wheel, and others in use; but what I do claim as my invention, is the peculiar manner in which I form the issues of my buckets; that is to say, by making the inner curves of the buckets, or those nearest the centre, segments of a circle which is concentric with the circumference of the wheel, and of lesser diameter; and the outer curves of the buckets, or those that are farthest from the centre, segments of circles of the same diameter, described from the points XX, (ranged on the periphery of the shaft,) the inner and outer sides of the buckets being spherical triangles, and nearly vertical, when the wheel turns in a horizontal position."

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43. For an improvement in *Presses for Cotton and other Substances*; Perry G. Gardiner, New York city, March 20.

The following claim, and accompanying sketch, will enable the reader to form a clear notion of this improvement:—

Claim.—"I hereby declare that I do not claim to have made any improvement in the single press; nor do I claim either of the parts, or devices, herein described, when taken alone, but what I do claim as of my invention, and desire to secure by letters patent, is the combining of one, or more, pairs of such presses, so as to give to the fol-

lowers, or plattens, of each pair, an alternating, or reciprocating, motion, by an arrangement of the operating parts, such as is represented in the drawing; that is to say, by the combined operation of the segment F, on the beam E E, and on the double toggle joints formed by one arm of the beam E, the shackle, or lever, D, and the progressive levers, or toggle joint, C C; the whole being combined and operating substantially in the manner, or on the principle, set forth. I do not claim the mere employment of double toggle joints to work two plattens, or followers, this having been before done, but in a manner essentially different from, and not producing a like effect with, that above described."



44. For an improvement in *Piano Fortes*; Ottaviano Gori, and Philip Ernst, New York city, March 26.

This improvement consists in methods of arranging pieces of glass, to be struck by hammers in manner similar to a piano forte. In one arrangement the pieces of glass are suspended from the sounding board by two wires, one near each end—the wires projecting down from a bearer in the sounding board, and having nuts at their lower ends to support the glass—the hammers striking from above, or below; and the other arrangement consists in stretching wires across from bearers, or studs, at each end, and securing the pieces of glass to the wires, by means of elastic glue—the hammers being arranged above.

Claim.—“We do not intend to claim the use of glass for musical purposes, nor do we intend to claim the mode of fitting the action parts; but we do claim as new, and of our own invention, first, the mode of mounting and adjusting the glass notes by the bearing, or suspending, bars, and the small wire rods and nuts, when applied to use in piano fortes, having either an under, or over, action, either separately, or in conjunction with wire, or string, notes; second, the mode of mounting, or suspending, the glass notes by the bearers, or by the strings, or wires, in combination with the mode of retaining such notes in place by elastic glue, made as described, when applied to piano fortes, having a downward action, such glass notes and mode

of suspending and retaining, to be either used separately, or in conjunction, with wire, or string, notes."

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45. For an improvement in *Mill Bushes*; John Heck, Boonsboro', Washington county, Maryland, March 26.

This bush is made in wedge formed segments, with a rod extending down from each segment, and passing through and being secured to a plate below, by means of nuts above and below, for the purpose of adjusting each segment separately; and for the adjustment of the whole together this plate is suspended by means of screw rods and nuts from the box of the bush.

Claim.—"What I claim as my invention, is the method of adjusting the segment bush to the spindle, and sustaining the same in the position required, by means of the screw rods and nuts, in combination with the stationary frame and box constructed and arranged as above set forth, or in any other mode substantially the same, wherein analogous results are produced."

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46. For an improvement in the *Refrigerator*; David Evans, Philadelphia, Penna., March 26.

Claim.—"I do not claim to have made any improvement in the general construction of the refrigerator, but intend to finish and arrange the interior thereof in any of the ordinary forms; but what I do claim as new, and desire to secure by letters patent, is the manufacture of refrigerators, as set forth, by the combining of a lining of slate, with a box, or outer case, of wood, substantially in the manner and for the purpose made known."

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47. For an improvement in *Roofing Houses with Tin*; John Woolley, Springfield, Massachusetts, March 26.

Claim.—"What I claim as my invention, is constructing metallic roofs without boarding, by means of strips fastened to the rafters by cleats, to which the sheets of tin forming the roof are attached. I also claim the shield plate under the eaves, constructed and arranged in the manner and for the purpose described."

The strips of tin are fastened on the top of each rafter, and extend from end to end, with the two edges turned up, and to these edges the sheets of tin forming the roof are connected by lapping over these edges, and then turning down; and the shield plate referred to in the second section of the claim, is for catching and conducting into the gutter all the moisture that condenses under the roof. For this purpose a plate extends from the gutter under the roof, there being sufficient space between this plate and the lower edge of the roof for the water, thus collected, to pass out.

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48. For an improvement in *Stoves for heating and culinary purposes*; Loammi Bailey, Boston, Mass., March 26.

This stove is divided into an upper and a lower fire chamber, the

former for burning coal, there being a basket grate in the plate that separates the two chambers, and the latter for wood, the draught for this latter passing through a hole, or pipe, in the division plate. The basket grate of the upper division is provided with culinary utensils. The draught of the two passes out through a pipe in the upper chamber common to both. By this arrangement either wood, or coal, can be used, or both, at pleasure.

Claim.—“I claim the combination with the partition fitted air-tight between the two fire chambers, as herein described, or the forming in said partition of a smoke pipe, or flue, communicating between the two fire chambers, the whole being arranged and operating substantially as herein specified, for the purpose set forth.”

49. For an improvement in the machine for *Cutting Sausage Meat*; William Pittenger, Rome, Richland county, Ohio, March 26.

A conical shaft, set around with pins, arranged spirally, and slicing knives towards the end, is placed horizontally in a box of an appropriate shape, to receive the meat through a hopper at one end, and discharge it at the other. The sides of this box are provided with knives that lie between the pins on the shaft, and by which the meat is sliced when forced against them by the pins, when the shaft is rotated—these sides being connected with the box by means of screws to set the knives.

Claim.—“What I claim as new, is the adjustable side pieces armed with knives, in combination with the revolving shaft, constructed and arranged in the manner and for the purpose set forth.”

50. For an improvement in the *Water-Wheel*; Nelson Johnson, Rathboneville, Steuben county, New York, March 26.

This improvement, like the other water-wheel noticed above, consists wholly in the form of the buckets, which cannot be clearly expressed in words, and as it is not deemed of sufficient general importance to give the drawings, we will simply insert the claim for the benefit of those who, having seen the wheel, may be desirous of knowing the limits of the claim.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the combination of the scalloped, hollow frustrum of a cone rim, with the spherical tapered buckets, and scalloped plate, in the manner and for the purpose set forth.”

51. For an improvement in *Weavers' Temples*; Isaac C. Lane, Waltham, Middlesex county, Mass., March 26.

Instead of a single wheel with sharp teeth projecting from the face, and ranged near the periphery, under this patent there are two crown cog wheels for each temple, one above the other, the under one placed horizontally with the cogs on the upper face, and the other placed above it, with its face making an angle of about ten degrees with the face of the under one, so that the cogs of the two mesh together only on one side. The upper surfaces of the cogs are grooved

parallel with the circumference of the wheels. The frame in which these wheels are mounted is so formed with a lip on each side, where the cloth enters to pass in between the teeth of the two wheels, and pass out, as to guide the selvage of the cloth. The object of this improvement is to avoid the injury which is alleged to be done to the selvage of the cloth by the pins used in the old temples.

Claim.—“What I claim as my invention, is the combining of two cog wheels together, the cogs of which are notched to prevent the cloth, held between the two wheels, from being drawn out, and these thus combined, I also claim in combination with the guides, for the purpose and in the manner described.”

52. For an improvement in *Hooks and Eyes*, to prevent them from unlocking; Elisha C. Savage, Hartford, Conn., March 26.

The hook is flattened, and instead of closing, or bringing, the two sides together, as in the ordinary way, the sides are separated from near the eyes, to a point just beyond the turn where they are curved, or swelled outward, forming segments of a ring, and then closed in again to make the point—the swelled part being wide enough to prevent the eye from passing on, or off, without springing them in.

Claim.—“What I claim as my invention, is constructing a hook in the manner described; the sides of said hook being separate, from just beyond the eyes thereof, to a point beyond the last turn of the hook, where the sides recede from each other, forming projections, over which the eye can only pass by springing in the sides of the hook, arranged in the manner and for the purpose set forth.”

53. For an improvement in the *Lamp* for burning lard and other concrete fats; John Lobin, Bloomfield, Essex county, New York, March 26.

In this lamp the lard, or other fat, is to be fed up by means of a packed piston, which is worked up and down by a vertical screw extending from the bottom to a little above the top of the reservoir. The piston is packed to prevent the escape of the lard, &c., and the screw, by which it is worked up and down, is hollow from the bottom to near the top, where it is pierced to permit the air to escape and pass in when the piston is forced up, or down. The screw also answers the purpose of a heat conductor. The wick holders are attached to a ferule slide, through which the screw passes, to prevent the wicks from coming in contact with the screw.

Claim.—“What I claim as my invention, is the combination of the cups, or piston, with the perforated screw stem, constructed and arranged substantially as described, and also, in combination with the cup piston and screw stem, the slide as above described.”

54. For a *Composition of Matter for making Aqueducts*, for conveying water, gas, &c.; Gideon Myers, Bridgewater, Oneida county, New York, March 28.

Claim.—“What I claim as my invention, is the before described composition of gravel, clay, water, lime, and salt, for making aqueducts, cistern pipes, tubes, and other articles.”

55. For an improvement in the *Stove, or Heating Apparatus, for burning anthracite coal*; John Smart, Philadelphia, Pennsylvania, March 28.

The fire chamber of this stove is the frustrum of an inverted cone, with the upper end bell-mouthed; this is placed within a hot air chamber, in the usual manner. The improvement claimed is in the substitution, for the common grate, of a perforated conical ring, suspended near the bottom of the conical fire chamber by journals attached to its greatest diameter, so that by attaching a shaker to its lower edge the ashes can be shaken out. The bottom of this rim, or basket, is either provided with a fire grate, or a series of perforated conical rims can be placed, one within the other, at small distances apart from each other.

Claim.—“I do hereby declare that I do not claim any of the devices described, as of my invention, with the exception of that for sustaining the fire coal within the heater, and of agitating the same; that is to say, I claim the circular rim formed as described, and suspended within the heater, so that it can be agitated by means of the shaker bar operating on its lower edges; secondly, I claim the combining with the said rim any number of similar rims attached to the shaker bar, as set forth, or, instead of the rims, the combining of the said rim with a grate of the ordinary form, with small bars and openings, by means of which arrangement I am enabled to burn the finer siftings of anthracite as effectually and advantageously as the nut, egg, or other sizes, of this coal.”

56. For an improvement in the machine for *Cleaning Wool, and applicable to Cotton*; Silas G. Mumford, North Providence, Rhode Island, March 28.

The wool is to be cleaned by the revolution of a tooth cylinder revolving within a case, to which it is fed by an endless apron below and through an aperture in the side of the machine. The moats, burs, &c., and the wool which is not cleaned by the first cylinder are thrown with some violence towards the back of the machine, where they may be acted upon by other cylinders, or thrown back into the machine, to be acted upon by the first a second time. The light and cleaned wool is carried up over the first cylinder, and out through a hollow trunk extending from the back of the cylinder under the feed apron, and out at the front, a strong current of air being produced in this trunk by the revolution of the toothed cylinder.

Claim.—“What I claim as my invention, is the manner in which I have arranged and combined the cylinder with its concave, the feeding apron and rollers by which the wool is presented to the action of the teeth on the cylinder, and the hollow trunk through which the cleaned wool is passed and delivered by the current of air created by

the revolution of the cylinder. I also claim the combining with the above claimed machine, the auxiliary cylinders with their appendages, operating in the manner and for the purpose made known. I do not claim the use of toothed cylinders, or of a feeding apron, or of either of the parts of the said machine, when taken individually, but I limit my claim to the combination and arrangement of the said parts so as to constitute a machine constructed substantially as described."

57. For a composition of matter for making *Bricks*; Nathaniel J. Wyeth, Cambridge, Massachusetts, March 28.

The object of this composition is to produce bricks which will admit of driving nails into them, to avoid the necessity of introducing in walls what are known amongst mechanics as "wooden bricks."—This composition consists of "clay mixed with either sawdust, charcoal, peat, or tan-bark, after it has been used by the tanner. The proportions may be varied, but the patentee recommends three parts of clay, to five parts of either of the combustibles above mentioned.

Claim.—"I do not claim mixing combustible materials with clay for making bricks, but I claim mixing them in such proportions as will produce bricks possessing the above named properties."

Patents Re-issued for Amendment.

1. For an improvement in machinery for *preparing and spinning Flax and Hemp*; Moses Day, Roxbury, Mass., March 30.

As this patent was only re-issued for amendments in the specification, the reader is referred to the notice of the original patent, which will be found at page 404 of this Journal, vol. i, of the 3rd series.

List of Improvements added to Existing Patents.

1. For an improvement in the *Hand Bench Plane*; William Foster, Washington, District of Columbia, March 16.

This is for an improvement added to letters patent granted to the said William Foster on the 24th day of November, 1843, (which has not yet been noticed in this Journal,) for a mode of lubricating the face of a cast-iron plane by making a recess forward of the bitt, into which is fitted a piece of bees-wax, tallow, &c.; and the improvement now claimed consists in making two such recesses either forward, or back, of the bitt, or both back and forward of it.

Claim.—"What I claim as my improvement, is constructing the plane stock, as above described, with one or more recesses formed in the face thereof, either before, or behind, the plane iron, in addition to the recess, as described, (in the original letters patent,) or both before, or behind, said iron, arranged substantially in the manner and for the purpose set forth."

2. For improvements in the *Cooking Stove*; Daniel Williams, Troy, Renssælær county, New York, March 26.

This is for an improvement which has been added to letters patent

granted to the said Williams, on the 21st day of November, 1840, and noticed in the third volume of this Journal, third series.

The patentee says,—“This improved stove, like that described in the said letters patent, consists of two parts, the one stationary, the other movable; the former contains the oven, the latter is the fire place, or cooking stove, with its appendages. The oven is elevated a little above the level of the top of the fire place, having a passage provided underneath extending from front to rear, into which a part of the fire place, or cooking stove, consisting of its flue and top plate, to the extent of the passage, is made to pass in and out, as the fire place, or chamber, is moved backwards and forwards in a right line upon the hearth, or platform, on which the standard plates of the oven are fixed.”

Claim.—“What I claim of the above described improvements, and desire to secure by letters patent, is the grate placed in the flue leading from the fire place, or chamber, of the cooking stove to the oven, constructed and operating in the manner above described.”

List of Patents granted for Designs, under the third section of the Act of August 29, 1842.

1. For a design, or figure, to be printed, or stamped, on painted cloth, or canvas, or other fabric, which are termed *Floor Oil-Cloth Carpeting*; Jacob D. Edwards, Elizabethtown, Essex county, New York, March 20.

As these designs are generally very complex, and often depend on coloring, the publication of them would carry this work beyond its limits, and without the plates it would be useless to insert the claim; we shall, therefore, simply insert the object of the designs, the names of the patentees, and the dates of the patents.

List of American Patents which issued in the month of September, 1841, with Remarks and Exemplifications. By CHARLES M. KELLER, Examiner of Patents.

(Continued from Page 255.)

29. For an improvement in the mode of making *Potash*; Daniel B. Turner, Florence, Erie county, Ohio, September 18.

The patentee says,—“In the old process of making potash six boilers and three furnaces have been used—one furnace having been kept constantly in operation, during the day, for heating the boiler containing the weak lye for melting down the leach, and the other two furnaces kept in operation for heating the four boilers containing the lye to be boiled down into potash. My improvement is designed to do away with all the fires and furnaces except one, whereby I reduce labor, curtail expense, and quicken the operation of making potash, and obtain a greater yield of the article, which I effect in the following manner:—

"There are two boilers, one beyond the other, with a flue from the furnace, which, after passing around and under them, has three branches, one leading under and around the third boiler, and the other two branching off, one on each side, to carry off the smoke, &c., without passing under the third boiler, and which also receives the heat, &c., that passes through the flue under the third boiler, by means of connecting flues. These various flues are provided with dampers to regulate, or close, them, as required."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the furnace with the two covered lateral, or branch, flues, in combination with the connecting flues furnished with dampers for regulating the degree, and changing the direction, of the heat, under and around the boilers, as described."

30. For an improvement in the *Pile Driver*; Robert N. Benson, New Orleans, Louisiana, September 18.

The object of these improvements is to make the pile driver continuous, and, therefore, more rapid in its action, which is effected by substituting two endless chains, connected together by rods, for the common mode of lifting the monkey, or hammer. The double chain passes around a driving drum at the bottom, connected by appropriate cog-wheels, with any first mover; from this drum it extends up to, and passes over, a drum near the top of the frame, and from this it runs, at an angle of about forty-five degrees, to another drum, and from this latter to a fourth drum back of it, which conducts it to the first, or driving, drum. The monkeys, or hammers, two, three, or more, in number, are provided with a hook jointed to them by the lower end, and hooked at the upper end, so as to catch on to the rounds of the double chain. There are two ways, one for the ascending, and the other for the descending monkeys, and these are separated by a spring guide on each side. The moment a monkey falls, the hook drops over and is caught by some one of the rounds of the double chain, by which it is pulled into the ascending way, the spring guides being pushed into their grooves by the sides of the upper part of the monkey, which are inclined for that purpose. When the monkey reaches the top it is carried over the upper ends of the spring guides by the inclined portion of the chain's passage, and as the hook is carried over the third drum, it is brought in contact with an inclined stop, which lifts it from the chain, and liberates it. In this way any number of monkeys, or hammers, can be worked in proportion to the length of the chain.

Claim.—"What I claim as my invention, is the method of raising the monkeys, or hammers, in succession, by means of the endless chain, or belt, constructed and operating as described. And I also claim the double spring guide constructed in the manner and for the purpose described."

31. For an improvement in *Prismatic Pavements*; John Abbott, Wilton, Hillsborough county, New Hampshire, September 25.

The blocks, whether of wood, or stone, are, as the title in the specification indicates, prisms of either four, or six, sides. If of four sides, two of them are grooved, to receive the tongues on the contiguous blocks, and the other two tongued to fit into grooves in other contiguous blocks; but if they are six sided prisms, then three sides are grooved and three tongued.

Claim.—“I shall claim constructing the prismatic blocks of pavements with grooves and tongues on their sides, by which they may be connected together, the whole being arranged substantially in the manner and for the objects, or purposes, set forth.”

32. For improvements in the *Corn Sheller*; Pierson Reading, Batavia, Clairmont county, Ohio, September 25.

We simply insert the claims, as they will indicate to the reader the character of these improvements with sufficient distinctness, viz.,—“What I claim as my invention, and which I desire to secure by letters patent, is first, the arrangement of the endless inclined feeding belt, with iron plates fixed thereto, in combination with the upward inclining hopper, and the revolving spur wheel turning in said hopper for adjusting the ears, so as to cause them to approach the sheller endwise, and these, in combination with the sheller and double springs, for shelling several ears at the same time, and the endless open cob conveyer, as described; secondly, the arrangement of the hinged shutter at the head of the inclined plane for yielding to an accumulation of ears, so as to permit the endless conveyer to work freely, as described; thirdly, the arrangement of oblique teeth on the face of the sheller, for giving the ears a forward progressive movement, whilst another set of teeth give them a rotary motion, and shell the cob, in combination with the (usual) teeth, as set forth.”

33. For a method of *Transporting Bales of Cotton*; Geo. R. Griffith, Mobile, Alabama, September 25.

The patentee says,—“The first part of my invention consists in securing each bale of cotton, against the introduction of water, by means of a case, or envelope, of India rubber, or other water proof cloth, which shall contain the bale, covering its bottom and its sides, and, when required on account of rain, covering it at top also.—Around the upper edges of these cases, or envelopes, I affix rings, or loops, in such manner, and so situated as shall enable me to attach the respective cases to a bale of cotton, by means of cords, or strings.”

“The second part of my invention consists in the manner in which I combine any desired number of such bales together, so as to form them into a raft, the extent of which will be limited only by its capacity of being managed with convenience, but which may be as extensive as the rafts of timber which descend the same rivers; whilst they may be navigated at periods when timber rafts cannot, as such bales will not usually have a draught of more than eight, or nine, inches, and the raft which they compose will, from its flexibility, yield in shoal places, where rafts of timber would be arrested.”

Claim.—“What I claim as my invention, is the forming, or constructing, of rafts of bales of cotton, by combining said bales together in the manner set forth; that is to say, by first providing each separate bale with a case, or envelope, of water proof cloth, made and attached thereto in the manner described, and attaching said bales to each other, so as to form a narrow raft, consisting of pairs of bales, by ropes running along the whole line, and by other ropes crossing from bale to bale, as herein described; and the uniting of these rafts of pairs laterally, by means of ropes between the separate pairs of bales to any required extent. And I do hereby declare that I do not intend to confine myself to the precise manner of attachment herein made known, but to vary this as I may think proper, whilst I attain the same end by means substantially the same.”

34. For an improvement in the *Bee-Hive*; Hiram A. Pitts, Winthrop, Kennebec county, Maine, September 25.

The improvement for which this patent is granted, is so distinctly pointed out in the claim, that we deem it unnecessary to add any explanatory remarks.

Claim.—“What I claim as new, is the manner set forth of constructing the bottom, or protector; the upper floor upon which the bees are to enter consisting of frames with wire gauze stretched across them, and there being below this a second, and, if desired, a third, floor, having spaces between them for the entrance of the bee moth, so prepared and furnished, in the manner described, as to induce the moth to deposite its eggs therein, and so arranged and connected with the hive as to be readily removed and replaced substantially as made known.”

35. For improvements in *Hot-Air Furnaces* for warming buildings, &c.; John A. Page, Boston, Mass., September 25.

Claim.—“I shall claim the sliding button applied on the crank shaft, in combination with the projections above the button, the same being for the objects and purposes fully specified. Also the mode of constructing the base sustaining the fire pot of the furnace, by making it in separate parts supported on temporary walls, or contrivances of a like character, built inside of the main walls of the ash pit, by means of which arrangement the fire pot, or either of the plates, can be easily removed at any time, and others substituted without disturbing the radiator, or materially disarranging any of the adjacent parts. I also claim the manner in which I have arranged the air tubes of the radiator over the furnace, by placing their lower extremities around the edges of the fire pot, and inclining them so that they shall converge towards each other at their upper ends, or where they enter the top plate of the radiator; also combining said pipes, so arranged, with an exterior hollow conical frustrum shaped casing, surrounding the same, by which mode of arranging the air tubes and casing, the fire is enabled to act more equally over their surfaces, than in the arrangements now existing, in which said tubes are placed perpendicularly

over the furnace, and inclosed by a hollow cylinder, the whole being substantially as described. I also claim the partition with its sliding valve and opening combined with the radiator, and arranged in the rear of the same in front of the entrance of the smoke pipe, and extending upwards to within a short distance from the top of the radiator, its object being the retention of heat, all as described. I also claim the method herein above explained of constructing the lower, or bottom, plate of the radiator, with a movable plate confined thereto by screws and nuts, by which arrangement a fire pot of a different diameter can be easily substituted, in the place of the one removed, by changing the movable plate for another having a circular aperture adapted to said fire pot."

The button mentioned in the first section of the claim, is for the purpose of facilitating the turning of the grate. The lower part of the fire pot is provided with boxes for the reception of the gudgeons of the turning grate; and when a grate is introduced it is passed in from the top of the pot, and one gudgeon passed into its box, which is elongated vertically for that purpose, and the squared end of this gudgeon fits into a socket in a shaft that extends to the outside of the furnace, where it is provided with a crank handle, with which to turn the grate to shake out, or discharge, the cinders; and to prevent the grate from turning, when not required, there is a sliding button, or plate of metal, on the end of the shaft, (which is squared for this purpose,) the upper edge of which lies under two projections from the side plate, or wall, of the furnace, and, whilst thus located, the grate cannot be turned, but when drawn out beyond these projections the grate can be turned with facility.

The other portions of the claim need no explanatory remarks.

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36. For an improvement in the machine for *Separating Garlic from Wheat*; Joseph Heygel, Salisbury, Somerset county, Pennsylvania, September 25.

The nature of this invention consists in providing a series of concaves arranged on an inclined plane, with oblique plates, on which teeth, in the form of those of a rasp, are cut; in each of these concaves rotates a winged wheel provided with metallic plates having teeth cut inversely to those on the first named plates. These wings propel the wheat and garlic with great velocity against the oblique plates, the teeth of which pierce and break the garlic into small particles, which, then being much smaller and lighter than the grains of wheat, are readily separated therefrom by a sieve and fan.

We are under the necessity of omitting the claim, as it refers and depends so much on the drawings that, without them, it could not be understood; it is, however, limited to the devices above indicated, in their combination and arrangement.

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37. For improvements in the machine for *pressing and finishing Bricks and Tiles*; Joseph B. Wilson, of Malden, and Alfred B. Crossman, of Huntingdon, Mass., September 30.

Claim.—“We claim constructing the mould (independent of the followers) of separate pieces, or plates, of chilled cast-iron, hardened steel, or other suitable material, fitted to each other by shoulders, as described, and arranged in a frame, and secured together by screws passing through the sides of the frame, the same being arranged and confined together by screw bolts, as explained, the whole being for the purpose of contracting the mould in its length, or width, and thus obviating, at any time, whenever necessary, and in any manner set forth, the difficulties resulting from the wear of the inner surface of the mould. We also claim interposing a piece of cloth, felting, or other suitable material of like character, between the plates composing the back follower, the cloth being, from time to time, saturated with any unctions, or fatty matter, the whole being for the purpose of lubricating the interior of the mould, as set forth. We also claim the machinery for producing the impression, and removing the brick from the mould, the same consisting of the eccentrics with their cams, or wipers, constructed, arranged, and operating together substantially in the manner explained.”

38. For a machine for *Planing Timber of various kinds*; Henry Law, Wilmington, New Hanover county, North Carolina, September 30.

“The board to be planed is to be dropped into a trough, or space, prepared to receive it edgewise, one end of said board projecting out beyond the end of said trough towards the plane stocks. The end at which the stuff is fed is called the fore end of the machine. The plane stocks are made to slide back and forth horizontally between suitable guides, a reciprocating motion being given to them by means of a shackle bar, or connecting rod, vibrated by a crank, and attached at one end to the plane stock apparatus. The shaft of the crank is placed horizontally, and has a fly wheel upon it, to regulate its motion; and this shaft may be driven by any adequate power. The crank may, in a machine of ordinary size, have a throw of seven inches, giving a vibration of fourteen inches to the plane stocks. As these stocks vibrate they approach the projecting end of the board contained in the trough, and said board passes in between them, and is seized and held by two iron gripes, which draw it onward towards the rear end of the machine, as the plane stocks recede from, but let go their hold as they advance towards the trough. When the board has been drawn to a suitable distance out of the trough, by the receding of the plane stocks, there is forced in at its fore end a bar of wood, or of metal, which serves as an abutment to prevent its return when it is being acted upon by the plane irons. There is a series of such bars, or abutments, crossing the trough from side to side, at a distance of about a foot from each other, when the vibration of the plane stocks is about thirteen, or fourteen, inches; the falling in of a fresh abutment at every stroke of the planes will be thus insured, and in this way twelve inches of the board will be planed at every vibration of the plane stocks.”

A series of planes consisting of four, or more, are arranged on each side for planing the surfaces of the board, and a series above and below for the edges, and for tongueing and grooving.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the manner herein set forth of planing boards, plank, or other timber, by means of reciprocating, or vibrating, plane stocks, operating upon stuff held by the iron gripes, and which stocks are to be moved back and forth to a short distance, say to that of a foot, more or less, and are to operate upon a corresponding length of the board, or other timber, to be planed, by means of a plane stock apparatus like that herein described. And I also claim, in combination with such reciprocating plane stocks, the manner of feeding the stuff to the planes, and of sustaining it against their action, by the combined operation of the gripes, which are to seize and to draw the stuff back with the backward motion of the plane stock, and of the sliding bars, or abutments, which are made successively to pass in at the fore end of the stuff, and sustain it against the action of the cutting, or plane, irons. And I do hereby declare that I do not intend, by the description given of the manner of forming and arranging the auxiliary parts of the apparatus, to limit, or confine, myself to the precise form of these parts, but to vary them as I may find expedient, whilst the general construction and operation of the machine remain substantially the same with that herein set forth; and whilst it is made to retain those features by which it is distinguished from all other machines which have hitherto been constructed for the same purpose.”

39. For a machine for making *Wire Heddles, or Weavers' Harness*; Abraham Howe, and Sidney S. Grannis, Morrisville, Madison county, New York, September 30.

Claim.—“What we claim as new, and desire to secure by letters patent, is the manner in which we have combined and arranged the shafts P and Q, and their respective stands, with the arm N, and its stud, the latter being made to revolve with the pinion M, the shafts and arm being made adjustable by an arrangement of parts substantially the same with that described. We also claim the mounting of the above claimed apparatus, upon a wheel revolving horizontally, the same being actuated substantially in the manner, and used for the purpose made known.”

When a heddle is to be formed the wire is turned around a vertical pin towards the back end of the shaft Q, carried from thence around a similar pin toward the back end of the shaft P, and then back again to and around the first mentioned pin—this forms the two end loops, and the wires thus disposed embrace three studs, one on the inner end of each shaft P and Q, and the third on the end of the arm N, and standing midway between the other two. The arm N, projects from a hollow shaft provided with appropriate gearing by which it is turned, and through it passes the shaft P, so that they can turn independent of each other. From this arrangement it is evident

that by turning the arm N, with its stud, which is midway between the other two, the two wires are twisted between each of the three studs, and a loop formed. All the parts are adjustable by means of slots and set screws, and the whole is mounted on a horizontal cog wheel, actuated by a crank handle and pinion, by which the operator can bring either end of the machine towards him, and coil the ends of the wire around the end pins.

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40. For an improvement in the *Plough*; Joseph and Henry F. Cromwell, Cynthiana, Harrison county, Kentucky, September 30.

We refer the reader to the following claim, which fully explains the character of the improvement for which the patent is granted:—

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the method of combining the mould board, point, and land side, or bar, of the plough, as herein set forth, viz., by constructing the land side and point in one piece detached from the mould board, and attaching the latter to it by means of a groove in the point and ears, riveted on the land side, through which bolts are passed, so as to secure the whole.”

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41. For a machine for *sticking Pins in papers*; Samuel Slocum, Poughkeepsie, Dutchess county, New York, September 30.

The pins are placed in a hopper with the heads all in one direction, and delivered into a series of grooves on the surface of a plate, by running the hopper over it from end to end. The grooves in this plate are large enough to receive and allow the heads of the pins to slide in them, except for a short distance along that edge of the plate which is towards the paper into which the pins are to be stuck, where they are reduced to the size of the shank of the pins: this not only guides the point of the pins whilst passing into the paper, but answers as a gauge to arrest them when pushed into the paper sufficiently far, which is effected by means of wires projecting from a sliding plate, or follower, like a comb, and which slide in the grooves.

Claim.—“What I claim as my invention, and wish to secure by letters patent, is first, the plate with the grooves for receiving the pins; second, the sliding hopper which deposits the pins in the grooves, as described; third, the sliding plate, or follower, with the wires attached thereto, in combination with the groove plate, as described, and also these in combination with the hopper, as described.”

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42. For improvements in *Locks for doors, safes, &c.*; Solomon Andrews, Perth Amboy, Middlesex county, N. Jersey, September 30.

The patentee says,—“My improvements consist in combining with the horizontal tumblers upon which the bits of the key have heretofore been made to operate, a corresponding number of upright, or vertical, sliding tumblers, which are to be lifted by the key, and which bear against and lift the horizontal tumblers; and also in giving to the said upright, or vertical, tumblers a peculiar form, which I

denominate the double belly, by which peculiarity in their form the key is made to act upon said upright tumblers, and through them upon the horizontal tumblers, in a manner which renders the operation of the lock much more certain and accurate than without such provision."

The double belly, referred to above, requires to be pointed out more clearly to enable the reader to obtain a clear idea of this peculiarity. The lower edge of the horizontal tumblers which turn on a pin projecting from the bolt, so that they travel with it, is so formed as to coincide with the upper edge of the vertical, or lifting, tumblers, when the latter are either up, or down, and, therefore, one portion of the lower edge must make an obtuse angle with the other equal to the amount of the angle of the lift; this is called the double belly, and it is necessary to insure the retention of the horizontal tumblers at the same elevation during their motion back and forth with the bolt.

We are under the necessity of omitting the claim, as it refers to and is dependent upon the drawings, but it is confined to the two improvements above explained.

42. For an improvement in the machine for *Rolling Dough and Cutting Crackers*; Riley Darling, East Greenwich, Kent county, Rhode Island, September 30.

This patent is granted for a mode of combining a machine for rolling the dough, by means of rollers and an endless apron, with a machine for cutting the crackers, by means of a double crank, the first of which is connected with and operates the cutter frame by means of a connecting rod and pendulous lever on the end of a rock shaft provided with arms that lift and force down the cutters on to the dough; and the second with the ratchet wheel of the rolling part by means of hands, or palls, to give an intermitting motion to the dough corresponding with the motion of the cutters.

Claim.—"What I claim as my invention, is the manner described of combining the operation of the two by means of the double crank, in combination with the connecting rod and pendulous lever attached to the cutting parts, and the hands and ratchet wheel attached to the rolling parts."

The machine for rolling the dough, and the machine for cutting crackers are separately disclaimed, as well as their combination, except in the manner specified.

MECHANICS, PHYSICS, AND CHEMISTRY.

Extracts from the Report of the Committee on Naval Affairs, to whom were referred certain communications from the War and Navy Departments on the subject of large wrought-iron guns, and in pursuance of the duty assigned them by the House of Representatives, submit the following Report:

ORDNANCE OFFICE, Washington, April 5, 1844.

Sir,—In reply to the resolution of the House of Representatives,

calling for information as to what experiments have been made by officers of the War Department, for the purpose of testing the strength and utility of cannon manufactured from wrought-iron; specifying such particulars as may tend to show the relative strength and utility of wrought and cast-iron cannon, together with copies of all reports from ordnance, or other, officers on this subject, and such other information connected therewith as may be considered useful; as also the experience of European powers on this subject, and particularly the largest size to which wrought-iron cannon for solid shot have been carried with success; and likewise the expenses of the experiments, and to whom the money was paid,—I have the honor to report:

That the only experiments for the purpose of testing wrought-iron guns, recorded as having been made by this department, are the trial of two six-pounder guns at Washington and Watervleit Arsenals in 1832, and the experiments now in progress, but not completed, at Fort Monroe Arsenal, with some guns of the same calibre.

In the experiment at Watervleit Arsenal, the gun was fired twice with a proof charge, and forty times with service charges.

The band which held the trunnions slipped off at the eighteenth fire, and the firing had to be stopped to replace it. After firing the forty two rounds, the gun remained serviceable, but the enlargement of the bore was found to be as much as .04 inch, which is more than double that of the bronze guns now made. This enlargement of the bore is the greatest objection to bronze artillery, and would soon render a gun unserviceable; and, so far as this experiment goes, it tends to prove that wrought-iron has no advantage over bronze in this respect, and, consequently, no greater durability. The particulars of this experiment, and of the mode of manufacture pursued in this instance, will be found in the report of Major Talcott, and the accompanying statement of the manufacturer, copies of which are inclosed herewith.

The trial at Washington Arsenal consisted only in firing proof charges, which left the bore of the piece in a condition unfit for service, by opening the seams, or welds.

By direction of the Secretary of War, some six pounder guns have been manufactured in 1843, according to a new method, which is not divulged, at the same price as bronze guns, and promising to unite the advantages of wrought with those of cast-iron. These guns are now at Fort Monroe Arsenal, where experiments to test their strength and durability are in progress. They are not, however, completed: and although, of those tried, one failed at the one hundred and fiftieth fire, by the trunnion band becoming loose, and another at the four hundred and fiftieth fire, by the opening of the welds, the results, so far, are not sufficient to warrant a definite conclusion as to the merits of this mode of fabrication.

So far as it has been tested by this department, wrought-iron has not proved a good material for the manufacture of field guns; and as the difficulty of fabrication increases with a greater quantity of metal, it is less suitable for those of larger calibre. The greatest objection, and, apparently, an insurmountable one, is the difficulty of welding

the parts together perfectly, and the still greater difficulty, or impossibility, of ascertaining whether the welds are perfect, or not. Besides, the effect of heating is to render the iron more porous, and of less specific gravity and tenacity; and, when often repeated, is known to destroy the good qualities of the best refined iron. When the bars are of small size, as in gun barrels, the hammering compresses and reunites the particles, and corrects these defects; but in large masses the effects of the hammer do not reach the interior of the mass, which is, consequently, left open and spongy, although the metal on the surface, and to a slight depth, is compact and fibrous.

The objects attempted to be gained by the use of wrought-iron for cannon, are 1st, lightness; and 2nd, strength.

1st. Reasoning from the successful use of that material for small arms, it has been supposed that a careful and skilful fabrication would effect these results. But lightness, below a certain ratio, is *not* desirable, it is positively injurious—for light guns can be used only with light charges. Field guns cannot be conveniently served when they have less than one hundred and fifty pounds of metal to each pound of shot, and battering guns require at least two hundred pounds of metal to each pound of the shot. With any less weight, the service of the gun is very difficult, from its excessive recoil; therefore, lightness is not a desirable point in the construction of cannon.

2nd. Strength. As this is always desirable, it should be effected, if possible, but not at the expense of any other important point. If it were possible to fabricate sound and strong guns of wrought-iron, they would be found deficient in hardness. The projectiles used are of cast-iron, a material much harder than wrought-iron; consequently, the wrought-iron gun is soon indented and worn so much as to prevent all accuracy in firing, and it then is worth little, or nothing.

Leaden balls are used in small arms; but they are inadmissible in cannon, as the great heat of the exploded gunpowder melts the lead more, or less, and changes the form of the ball, thereby reducing its range; besides, lead has not sufficient tenacity to enter hard substances, and, therefore, is not a suitable material to be used against ships and batteries. Wrought-iron is also more liable to injury from rust, than bronze, or cast-iron; and the smallest crack admitting moisture, would, of itself, in time, seriously injure the gun. The first cost of wrought-iron cannon is the same as that of bronze, and more than six times that of cast-iron. Bronze guns, it may be further remarked, after being too much worn for service, can be easily recast, whereas the old wrought-iron is useless for refabrication, and of little value in such large masses for any purpose.

In regard to the experience of European powers on this subject, it may be stated, generally, that the use of wrought-iron as a material for cannon, has been attempted in Europe repeatedly, without success, from the invention of fire arms to this time. The cannon of small size have succeeded better than larger ones; indeed, there is no known record of a wrought-iron gun for heavy shot proving satisfactory. The works of European writers on artillery abound in notices of

wrought-iron cannon, of dates of manufacture extending back from the present century to the remotest periods of their use.

Frequent instances of accidents from their bursting are mentioned, and they have never been successfully manufactured on a large scale. Meyer, in his work entitled "*Experiments in the Fabrication and Durability of Cannon, both Iron and Bronze*," edition of 1834, says: "It is certain no experiment in artillery has been as often unsuccessfully repeated and abandoned as the fabrication of wrought-iron cannon; and even at this time we are but little further advanced in it than at the beginning;" and Gassendi, in his "*Aide Mémoire d'Artillerie*," edition of 1819, condemns the use of wrought-iron for the manufacture of cannon entirely.

Herewith are submitted extracts from different writers, containing a chronological history of wrought-iron cannon, and remarks on the use of this material for their fabrication.

In regard to "the relative strength and utility of wrought and cast-iron cannon," the former having been already noticed, it may be stated in reference to the latter—

1st. As to the strength. Cast-iron is of so many different qualities and kinds, and so variously affected by different modes of fabrication, that it is impossible to speak of the strength of cast-iron guns *generally*. It is known, however, that, by careful attention to the selection of the metal, to its treatment in the furnace, to its proper distribution throughout the body of the gun in relation to the force exerted on its different parts by the discharge, to its gradual cooling after being run into the moulds,—in a word, to all the manipulations connected with its manufacture; and by a judicious, moderate proof, serving to detect any flaws, or imperfections, which may have escaped observation during the manufacture, and not so severe as to strain, or weaken, the cohesion of the particles, cast-iron guns, sufficiently light for siege, seacoast, and garrison service, may be made, the use of which, with full charges, will be safe for at least 1000 fires. But although the practicability of making good and safe guns of cast-iron is believed to be an established point, it must be admitted that it requires a constant supervision and vigilance, which can only be obtained by means of a foundry under the entire control of the government, or the employment of a skilful practical officer to attend at the private foundries during the whole process of fabrication.

2nd. As to utility. In former times it was supposed that bronze only was suited for heavy guns, both on sea and land: and it was only after great advances had been made in the arts, that the maritime powers of Europe ventured to use cast-iron guns on board their ships. The less cost and greater hardness of cast-iron, therefore, have led to its use for artillery; and when it is considered that six or seven cannon of this material can be procured for the same cost as one of bronze, or wrought-iron, it will readily be perceived that, if we can fabricate them in such a manner as to render them safe for only one thousand fires, they should be adopted on the score of economy, and their accuracy of fire up to the period of their being laid aside; accordingly, all the European powers have fabricated their heavy guns,

for ships and batteries, of this material—using bronze only for field and siege trains.

The British troops, in the Peninsula war, on several occasions found their siege trains of bronze speedily rendered unserviceable, and resorted to cast-iron guns; the superiority of which, over bronze, consisted in their greater accuracy, and being less heated in rapid firing; and they are stated to have endured two thousand seven hundred discharges. “These pieces had preserved such accuracy of fire, that in the last days of the sieges they were fired from a great distance over the heads of the besiegers at the breach, with sufficient precision to reach the besieged behind a high rampart.”

The expenses of the experiments in wrought-iron cannon made at Watervliet and Washington Arsenals, consist only of the cost of the ammunition used in firing them, which was taken from that on hand at those arsenals. Nothing was paid for the guns. For the experiments now in progress at Fort Monroe Arsenal, the expenses consist of the cost of the necessary ammunition prepared at the arsenal, and the price of the guns, (\$2100,) which has been paid to the manufacturer, Mr. Daniel Treadwell, of Massachusetts.

The resolution of the House of Representatives is herewith returned.

I am, sir, very respectfully, your obedient servant,

G. TALCOTT, *Lieut. Col. Ordn.*

Hon. William Wilkins, Secretary of War.

Watervliet Arsenal, May 24, 1832.

Sir,—Mr. Reuben Hunt, of Canaan, Litchfield county, Connecticut, has brought to this post a wrought-iron six-pounder cannon, a drawing of which is inclosed herewith, together with a description of the mode of manufacturing the same. As it appeared by your letters of 22d August, and 7th November last, which have been shown to me, that you were desirous of having this work tested and proved, and he not having the means of fully proving the gun, I have deemed it an object of sufficient importance to the government to warrant my proceeding to prove and try it, without specific orders upon the subject.

The gun appears to be sound in the bore; some small flaws in the welding are perceptible, but no cavities of sufficient depth to injure it materially. It is not very smoothly bored, nor is it of the proper calibre; all which errors are believed to be within the reach of correction when the manufacture is undertaken on a proper scale, and with suitable tools. The exterior appears perfectly sound and smooth.

It was proved twice with four pounds of powder, (old powder, the best we have,) giving a range of about 250 yards, with the new eprouvette, two shots, and two wads, and was then fired forty rounds with one and a half pound of powder, one shot, and one wad. At the eighteenth round, the gun slipped out of its trunnions, and it was then discovered that the band, into which the trunnions were welded, was put on very imperfectly, hardly touching the body of the gun, except at its upper and lower edges. A new band was made, and put on

carefully, after which the other twenty-two rounds were fired, without effecting any perceptible change; and it is believed that the gun, in its present condition, would stand service. Annexed to the drawing is a statement of the diameter of the bore before proof, and also its condition after all the firing was finished, by which it appears that a small increase, or expansion, has taken place. The iron seems to be of good quality, tolerably hard for forged iron, and the inequalities of the shot have made very little impressions upon the bore—nothing like the effects that would be produced upon a brass gun subjected to the same trial.

The gun remains here, subject to your orders. The expense of removing the band and trunnions, including labor, coals, and iron, was \$21.22, which amount will be chargeable to Mr. Hunt, unless you should authorize the expenditure.

Very respectfully, I am, sir, your obedient servant,
GEO. TALCOTT, *Bt. Major, &c.*

Col. G. Bomford, Ordnance Office, Washington.

From Meyer's Historical Manual of the Technology of Fire Arms, from their invention to the present time. Paris edition of 1837.

According to Vassius, the Chinese had, in the year 1055, cannon of bronze and wrought-iron, which were worked with much skill.

A wrought-iron cannon was found in the ruins of the castle *Uf Huger* on the Rhine, which castle was destroyed in the year 1308.

In the year 1338, the Teutonic order had three bombards of wrought iron.

At the siege of *Eu*, in 1340, the English had large wrought-iron pieces, with which they threw round stones.

According to Villani, the English, in 1345, had wrought-iron cannon before *Monségur*. *Darriel* says that there are indications of the existence of wrought-iron cannon and of powder at *Toulouse* at this time.

Siege of Claudia Fossa by the Venitians in 1366. *Ligurius*, speaking of this siege, says that some Germans came with two small wrought-iron pieces, firing leaden balls, which they offered to the Venitians, and that they used them with great advantage.

Description of the bombard by *Redusius* in 1427. It is of wrought-iron, and is composed of a straight bore behind, which widens like a funnel towards the mouth; the forward, or funnel shaped, part is eight calibres long, the rear part sixteen. In the straight part of the bore is placed an artificial mixture of saltpetre, of sulphur, and charcoal; the entrance is closed with a wooden tompon, on which, in the widened part of the bore, the stone bullet rests. This mixture is fired by means of a small aperture behind.

1439. *Facius* says that bombards are made either of wrought-iron, or copper; the two tubes, of which they are composed, being either run together, or joined to each other, on the same stock.

In 1452, there was used before *Oudenarde* a wrought-iron cannon made of bars. It had a chamber containing one hundred and forty

pounds of powder; its calibre was twenty-two inches; its circumference ten feet ten inches; its weight thirty-three thousand pounds; it threw stone bullets, or small casks filled with broken glass, scraps of iron, &c. It was called *Margot la Folle*.

In 1494, Charles VIII suppressed entirely wrought-iron bombards, and had no other artillery than that of bronze.

In 1544, mention is made of a wrought-iron piece used in the defence of St. Dizier; it weighed six thousand eight hundred and thirty-one pounds; was eight feet two inches long, and it projected eight cubic feet of stone at once.

There is at the museum of Paris a wrought-iron piece of 1555, very long, but of small calibre, with a movable breech.

In 1833, there were at Strasbourg several wrought-iron cannon bearing the date of 1602; some of which were made to load at the breech.

1621. The cannon called *abraca*, are loaded by means of separate chambers. These pieces are usually of wrought-iron, and of calibres as high as one hundred pounds. Sarti saw some at Gand, and at Amsterdam—one of which weighed 33,000 pounds—where they were used principally on board of vessels. Venice has many pieces (fifty pounders) of this kind on board of her galleys, where they are mounted on carriages. The chambers are of wrought-iron, or bronze, three for each piece. They are fixed in behind by means of wooden wedges; at the moment of firing, those serving the gun stand on the sides.

In 1660, there was cast in India a large bronze cannon, with a wrought-iron bore of six inches diameter, weighing seven thousand seven hundred and twenty-six pounds.

1661. There is at Berlin a wrought-iron piece of this year, for a two ounce ball, rifled with thirteen grooves, with a screw breech, and a sight turning on a hinge.

There is now at Woolwich (1830) a wrought-iron piece, made at Nuremberg in 1694. There was at Zurich, in 1694, an old wrought-iron cannon composed of many pieces, easily separated from each other.

In 1697, there were made some wrought-iron pieces, composed of bars wrapped round a core. An eighteen-pounder of this kind burst at the first fire.

The wrought-iron cannon made at Ocona, in 1744, stand well the proofs to which they are subjected. These cannon are now (1832) in the museum of Paris. They are of calibres of three and a third and two and a half inches; five feet one inch long. One of them weighs two hundred and ten pounds.

1747. Senner fabricates cannon of wrought-iron, the bores of which are grooved, and the bottom of the bore movable.

1753. There is at the arsenal of Paris a handsome wrought-iron twelve pounder, manufacture of Gentin, weighing one thousand six hundred pounds. It was made solid, and bored out.

1764. There are at the arsenal of Paris three wrought-iron cannon—one twelve and two eight pounders. These pieces, made on

spindles, or cores, are composed of longitudinal bars covered with bands; the whole welded together.

1765. Anciola caused to be made at Pagaloga, in Spain, three wrought-iron pieces—one four-pounder long, one four-pounder short, and one eight-pounder. Bars of iron were used of one and a half inch in thickness. These pieces forged solid, and afterwards bored and turned, sustained, without injury, the proof firing, with charges of the whole weight, and two-thirds the weight of the ball. A royal order directed the fabrication in the same manner of two twenty-four pounder cannon, (weight twenty quintal—4,400 pounds English,) two sixteen-pounders, (nineteen quintals—4,180 pounds English,) and two twelve-pounders, (sixteen quintals—3,520 pounds English.) Some of these pieces were cracked in the proof. In one of these a new breech was put, and it stood proof. They were forged by hand.

There is at Paris (1830) a very handsome wrought-iron mortar, six and a half inches bore, weighing two hundred and twenty pounds, and made in 1775, at Madrid, by Ortega. The collection at Woolwich contains a German wrought-iron piece of 1775.

Norbec saw at St. Sebastian, in 1780, wrought-iron cannon proved at that place in 1765, and which had remained since that time under an open shed. They were, he says, but little affected by rust.

1782. In France much interest is taken in wrought-iron pieces. Langevin has made two four-pounders to the order of Marshal de Castries; and Bradelle, of Bordeaux, has made many for the owners of privateers, at the rate of twenty-five sous per pound.

1796. In France bronze artillery proves again to be of little durability. La Martilliere supposes that at the peace there will not be less than one thousand four hundred and ten of these cannon to recast, being completely unserviceable. He proposes to make, of wrought-iron, small chambered pieces, such as are used at sea, to load at the breech.

1804. They manufacture in France wrought-iron pieces.

1810. The French find in Spain wrought-iron pieces, which the people of the country say had been used in the wars against the Moors.

1812. Fabrication of a wrought-iron three pounder at Gleiwitz.

1813. In France the company St. Etienne offers to deliver daily eight twenty-four-pounders of wrought-iron. An eight-pounder presented for trial sustains four fires with three pounds of powder, and five fires with four pounds. This piece appears to have been composed of bars wound round an iron tube, and joined with silver solder, and a screw breech. The cost of fabrication was not to exceed that of recasting bronze pieces.

1820. Professor Persy, in his "Notions on the Forms of Cannon," proposed to forge iron pieces on a core.

1828. Horton takes out a patent for wrought-iron cannon. The wrought-iron cannon made at Gleiwitz, in 1812, is proved. It becomes much heated, and cracks; but sustains, notwithstanding, a great number of charges with ball, and a charge of powder half the weight of the ball.

1830. A cannon made of bar-iron wrapped spirally, and soldered with copper, does not sustain the proof fire.

From "Experiments on the Fabrication and Durability of Cannon, both Iron and Bronze," collected and arranged by Moritz Meyer; Paris edition of 1834.

It is certain that no experiment in artillery has been as often unsuccessfully repeated and abandoned, as the fabrication of wrought-iron cannon; and even at this time we are but little farther advanced in it than at the beginning. It is known that the cannon which were called bombards, were composed of bars of iron, held by circles, like the staves of a cask; shortly after, they were brazed together. At this time their chief use was to fire against cities; and as there was, consequently, little need of accuracy of fire, and the powder was weak, and the projectiles of stone, these clumsy and badly made machines were sufficient; they did, however, frequently burst; as, for example, at the siege of Constantinople, by the Turks, where a bombard firing stone projectiles of four hundred and eighty kilogrammes (1056 pounds English.) weight, burst at the first fire, and killed many persons. James II, King of Scotland, was killed at the siege of Roxburgh, in 1460, by the bursting of a bombard. Ancient writers, such as Miethen, Sardi, &c., relate that wrought-iron cannon frequently burst in rapid firing.

Subsequently, cannon seem to have become more defective, as the artillery corps became better instructed. Guns of large calibre were abandoned, which facilitated the fabrication; but, at the same time, greater exactness was required, and cast-iron balls were introduced; a greater number of pieces were used, and the firing was more rapid; whence the fabrication, already defective and difficult, became more so. It was then increased by the introduction of trunnions. But, in consequence of the great uncertainty of the results of the different welding heats, which often burnt the metal in some of its parts, the fabrication of wrought-iron cannon was abandoned in the middle of the fifteenth century, for the introduction of cast-iron. Nevertheless, reckoning on the progress which had been made in the art of metallurgy, it was resumed in later times, with the hope of overcoming the difficulties which had formerly been regarded as insurmountable. Thus, in the sixteenth and seventeenth centuries new experiments were undertaken, but after a new method. Massive cannon were forged by means of *skelps* suitably prepared. The archives of the arsenal of Paris mention a twelve-pounder wrought-iron cannon, weighing sixteen hundred pounds, made in this way in 1753. There are to be seen at the museum of the artillery school of Strasbourg, four wrought-iron pieces, weighing from ninety to one hundred pounds; one of which bears the date 1601.

At the commencement of the last century, new attempts were made in France to introduce the manufacture of wrought-iron cannon by a new process. It was proposed to envelope them with solid bands. A very high price was asked for cannon made in this way, under the

pretence that they must offer great advantages, because the direction of the fibre of the iron was perpendicular to the axis of the gun, where the greatest strain from the ignited powder was exercised.

St. Remi, in his Memoirs, mentions the process followed on this occasion; but he adds, that, notwithstanding the assurances of one of the manufacturers on the excellent quality of an eighteen-pounder, which he presented, it *burst at the first fire into two pieces, and killed and threw into the Seine many persons*. He also mentions a wrought-iron cannon composed of seven pieces, which offered the advantage of easy transportation; but he adds, that it burst into small pieces at the proof. In 1745, several wrought-iron eight and four pounder cannon were tried at Toulon. They resisted charges of six and four pounds of powder. After several discharges, one of them (an eight-pounder) began to crack; but, notwithstanding, it still stood many fires, and it was not broken in pieces but with much trouble, and after using powerful means.

In the present century, though not far advanced, much ingenuity has been exercised on this unfruitful subject. But although more light has been thrown on it than in the preceding century, we have not yet succeeded in satisfying the requirements of artillery.

The experiment which has succeeded best, took place in France in 1813. The company *Etiienne* offered to the government a wrought-iron eight-pounder, weighing eight hundred pounds, which, according to Gen. Gassendi, (page 784, 5th edition,) had the bore forged in the same manner as a musket barrel, (similar ones had already been proposed before;) the bore was closed by a screw breech. This cannon sustained four fires with eight pounds of powder, and three with five pounds. This company engaged to deliver twenty-four pounders, which should not cost more than bronze guns of the same calibre. In Silesia they have forged many cannon of a single piece, but which have not given satisfactory results. We have seen two cannon which were wrought in a German shop, and which were formed of twisted bands of iron, but they broke to pieces in the proof. At the Carron works, in Scotland, experiments have lately been made on pieces composed of iron bands, and an Englishman has taken out a patent for it, but the results are not known abroad.

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An objection to wrought-iron guns, which appears much more serious than liability to rust, arises from the great difficulty experienced in their fabrication on a large scale, which permits the doubt whether it can ever furnish a supply sufficient for all wants. When we consider the difficulty experienced in finding plates for musket barrels free from defects, even when they have been prepared with care—and even after that, how many of these barrels are filled with flaws and cracks; when we know how difficult it is to weld together pieces of large dimensions, without leaving some places of imperfect junction, which may afterwards permit the rust, or the fire, to penetrate; how difficult it is to discover this defect by proof, or otherwise; and, finally, how negligent the workmen, and how inattentive even the overseers in the shops are,—it must be admitted that a wrought-

iron gun, which ought to undergo the most rigorous proof, would not, even if it should therein prove perfectly satisfactory, afford all the necessary guarantees; and the success of no one would warrant the adoption of their manufacture on a large scale.

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Wrought-iron (as a material for cannon) fulfilling the requisite condition of tenacity, has naturally attracted attention. The difficulty of fabrication has not stopped some manufacturers. It seems, indeed, that this obstacle is susceptible of being overcome; and that it has been, as is proved by the wrought-iron guns which exist at present, and some of which date back to very remote periods. Besides, working in iron has, in late times, made great progress; and there is reason to believe that if a reward and a large order were secured to him who might present a wrought-iron cannon of sufficient strength, a manufacturer, at reasonable prices, would quickly be found. But the condition of resistance to the explosion of powder is not the only one to be fulfilled. It is also requisite that the bore of the guns should resist the pressure and the balloting of the balls. For many experiments prove that lodgments of the balls are often formed in the bores of wrought-iron guns so quickly as to leave doubts as to the great advantages which many authors have attributed to this kind of cannon.

From Gassendi's Aide Mémoire: Paris edition 1819.

But these wrought-iron pieces, and others like them—are they good? ought they to be adopted? No. Because,

1st. They soon destroy the carriage by the suddenness and length of the recoils.

2nd. Because of the serious inconvenience to those serving the pieces from the length of the recoil.

3rd. On account of the alteration in the ranges by the continual and inevitable oxidation of the bore.

4th. The moral effect on the gunners, from the fear of their bursting.

In fact, these pieces often burst, although the first which are presented by the inventors for proof do not always do so, because they use for them selected metal, and carefully watch their fabrication; but, in making a number, is it to be hoped that the metals will be as scrupulously selected, and that an observing and practiced eye will watch over the degree of heat which the metal ought to have in order to work solidly the immense number of welds necessary to finish the piece; then, from firing, the imperfect welds will be imperceptibly opened; moisture will penetrate the fissures, which, increasing to a certain extent, will cause the gun to burst; exfoliations will be formed in the bore, which will retain fire and cause accidents. Finally, the irremediable oxidation of the bore in time of war will so enlarge it, as to render the guns unserviceable, and, in time of peace, there will be the trouble of keeping them constantly painted to prevent this oxidation. We have been thus profuse on the defects of these pieces,

to answer, once for all, an innovation which appeared good, and which is often represented as something new.

Mr. Rhodes, a very skillful and practical naval constructor, who was employed for some time by the Turkish government, states that there are in the arsenal at Constantinople many wrought-iron cannon of calibres varying from one hundred pounds to the smallest sizes. These guns have all been thrown aside, and are no longer considered as suitable for service. By direction of the Sultan, some of them have been cut up, both in cross sections and longitudinally, to ascertain the manner of their fabrication. They were found to be composed of bars surrounded by bands, like the staves and hoops of a cask, the whole welded together—those of larger size being formed on a *mandrel*, and the smaller ones forged solid and bored out. They were composed of successive series of these bars and hoops, laid on each other to make the requisite thickness of metal, and the junctions of these layers, as also of the bars and hoops of the same layer, were distinctly perceptible. The defects were enlargements and batterings of the bores, arising from the effects of the charges on the soft metal composing the guns.

Bureau of Ordnance and Hydrography, April 2, 1844.

Sir,—In reply to your letter of the 28th ult., transmitting a call from the House of Representatives, for information respecting the strength, utility, and cost of wrought-iron cannon; and the result of the experience of European powers on the subject, which may be in the possession of this bureau,—I have the honor to submit the accompanying papers, marked from Nos. 1 to 4, viz:—

No. 1.—Capt. R. F. Stockton's report of his gun practice with his wrought-iron gun at Sandy Hook.

No. 2. Report of inspection of the first gun, by Commodore Wadsworth.

No. 3.—Capt. Stockton's report of proof of gun.

No. 4.—The cost of each of the wrought-iron guns, made under the superintendence of Captain Stockton, so far as paid for by this bureau.

Our information in relation to wrought-iron cannon is very scanty. Tousard tells us, in a note to page 190, volume first, *Artillerist's Companion*, that "in 1776 an iron gun was forged by Mr. Samuel Wheeler, an eminent artist, still living (1809) in the city of Philadelphia. It was intended, at first, as a four-pounder, but was only bored for a three-pounder. This gun was taken at the battle of Brandywine, and is said to be now in the Tower of London." I believe this is the only gun of which we have any record in this country, as having been used in actual warfare, and, as it appears, with success. The next account of the manufacture and proof of wrought-iron guns in this country, is found in the report of a board of officers of the army, as follows:—

"A six-pounder wrought-iron gun, manufactured by R. & S. Hunt,

anchor makers, was tried at Watervliet arsenal, in 1832. This gun was fired two proof charges, and forty rounds service charges. At the eighteenth fire the band which held the trunnions slipped off, and had to be replaced. After the forty rounds, the gun still remained serviceable. The greatest enlargement of the bore was found to be 0.04 inch—which is more than double that of any of the brass guns proved lately; from whence we may infer, that if all difficulties were overcome, and a complete iron gun made, it would have no great advantage over bronze, as regards its durability. It is understood that these same manufacturers failed in making other wrought-iron guns.

“Although a proof gun can be made when the metal is selected with great care, and the fabrication carefully watched, yet, in fabricating them on a large scale, it will be impossible to take the precautions necessary to insure the perfectness of all these numerous welds. The smallest crack would contain moisture, which would produce oxidation; and this would, in time, destroy the gun. The board do not think it necessary to incur further expense in testing this material.”

Again, says this report,—“Guns of this material (wrought-iron,) were the first used, and they have been tried at various periods since the first invention of gunpowder, and always without success.

“The first and greatest objection is the difficulty of welding the parts together perfectly, and the still greater difficulty of determining whether the welds are perfect, or not. In the account of a wrought-iron gun, tried at Toulon, in 1745, it is stated, that after the gun was broken up, the cascabel and trunnions were found to be held only by a portion of the faces which touched. Three-fourths of these faces showed the effects of rust.”

It appears from most authorities that the art of casting guns was esteemed a great improvement upon the more ancient art of forging them, and, whatever may have been the cause, immediately superseded the latter. The cause may have been the vastly diminished cost of the cast-iron guns, or the facility of manufacture, or the opinion of greater security and certainty in the use; or, probably, the combination of all of these. Certain it is that the forged guns went entirely out of use.

Several accounts of these forged iron guns are given by writers on artillery. Tousard says, page 168, vol. i,—“There are at present (1809) on the ramparts of Narbonne, two old pieces, composed of iron bars, applied lengthwise, and encircled with strong iron hoops transversely, the whole soldered together. They are not much altered, although they have been neglected for a long time; but the rust has injured them most in the points of junction, and made these more apparent. It is probable that if, at the time when they were made, the arts had been as far advanced as they are at present, they would still be fit for service.”

“New attempts have lately been made in France, at Guerigny, department de la Nièvre, and in Spain, at Caveda, New Castile, to construct such guns, and they have been crowned with success. But

at first, when compared with cast-iron guns, wrought-iron heavy ordnance would have been attended with considerable expense, as well from the price of metal as from the attention which their fabrication requires; and secondly, the enormous consumption and want of cannon at that time (1794) compelled a recurrence to the most expeditious and least expensive proceedings—therefore, to confine their fabrication to cast-iron. However, they are not half as expensive as brass guns.”

It may be remarked here, that Tousard was strongly in favor of experimenting upon wrought-iron cannon, with a view to their introduction into the service of the country. He observes, however, of cast-iron, “that if it was by some means possible to produce a more perfect melting of the iron, cannon cast of this metal, with an equal thickness, would be stronger, more durable, and lighter than brass cannon,” page 198. He gives the preference, however, to brass cannon, because “the service of which should present more security.”

Grose, in his *Military Antiquities*, vol. i, page 381, says that cannon “were, in general, constructed of iron bars soldered, or welded, together, and strengthened with iron hoops; others were made of plates of iron rolled up, and fortified with iron hoops.” He speaks of several “at Woolwich—one belonging to ——— Pooley, Esq., in Suffolk,” and “also several of those hooped guns in the Isle of Man, England.” Bombards were at first chiefly made of hammered iron; but, in process of time, many were cast of that composition named bell, or gun, metal. They were also sometimes made of plates of iron and copper, with lead run between them. One of these guns was taken up on the coast of Ireland.

That wrought-iron guns, constructed of iron bars hooped together were used very generally, we know from the specimens yet preserved and the facts of history. James the Second, of Scotland, lost his life before Roxburgh castle, by the bursting of one of these guns. In 1545, a man-of-war, named the “Mary Rose,” commanded by Sir George Carew, sunk off the Isle of Wight, with her whole crew. Three hundred years nearly after the accident, Mr. Dean, with his diving apparatus, raised a twenty-four pounder brass gun, and, at the same time, some iron guns. The iron guns were formed of iron bars hooped together with iron rings; and they were all loaded, &c.—*Wilkinson's Engines of War.*

“In 1813, a company of mechanics of Lyons, named the ‘Etienne Company,’ proposed to the French government to manufacture all the guns wanted of forged iron. They sent to Paris a specimen eight pounder, weighing five hundred and seventy pounds. It was mounted upon a truck carriage, with solid wheels, seventeen inches in diameter, and fired with three pounds of powder. The recoil was twenty-five feet; with four pounds of powder it was thirty-seven feet. The gun sustained nine rounds without injury; but the material was not approved by the French officers. Other pieces of the calibre of sixteen and twenty-four were made; the mode of fabrication seemed to be this:—Upon a tube formed after the manner of a common fowling piece, or gun barrel, bands of iron were welded, embracing the tube,

but in a direction contrary to that of the fibres of the tube, until the requisite size and strength were obtained. The gun was bored out to the proper calibre, and the breech piece screwed in and soldered to its place by silver solder, which was esteemed the best. The different bands of iron were welded to each other, and to the tube, by blows from the hand hammer.

"The inventor proposed to employ in the fabrication of twenty-four pounders, &c., bars of iron twelve feet long by one foot eight inches, which, forged out into skelps, and converted into bands thinned off at the sides, were welded together over a mandrel, under blows of a trip-hammer. The trunnions were welded to one of these bands. The bars used were twisted, and they believed that, as the small arms manufactured were excellent, this process augmented the tenacity of the metal by a fourth; and this was their secret.

"But extending the manufacture on a great scale, could we hope that the metal shall always be scrupulously chosen, and that a practiced and observing eye shall always watch over the degree of heat which the metal ought to have, in order to work to a uniform solidity the prodigious quantity of welding necessary to perfect the piece? When the gun is fired, the imperfect weldings will open imperceptibly, and the damps will penetrate the fissures, which, after a time, will cause the gun to crack, and form within the bore leafy exfoliations, which, retaining the fire, will occasion accidents. In short, the irremediable oxidation of the bore in time of war will so enlarge it, as to throw the piece out of service; and in time of peace they would require frequent painting to prevent this oxidation."

"The objections to the wrought-iron gun are continued thus:—

"1st. They promptly destroy the carriages by the suddenness and extent of the recoil.

"2nd. They incommode greatly the troops, by the length of the recoil.

"3rd. They will change their range greatly, by the continued and inevitable oxidation of the bore.

"4th. They enfeeble the moral of the cannonier, by the continued apprehension of their bursting.

"In fact, these guns often burst, although the first pieces furnished by the company for proof did not always burst. We have thus dealt at large upon the defects of wrought-iron guns, in order to reply, once for all, to the pretensions of an invention which claims to be good, and is often represented as new."—*Aide Mémoire*, vol. ii, page 784, &c. Paris, 1819.

Some of the Spanish writers speak of wrought-iron guns: thus, Ciscar, in his *Tratado de Artilleria*, Madrid, 1829, says,—"We do not owe the information that wrought-iron cannon of all descriptions formerly existed, to the Chevalier d'Arcy alone, but also to many writers. Texier de Norbec, amongst others, treats at length of various guns of this kind. From 1666 to 1694, there was one in the arsenal of Zurich, in Switzerland, of twenty-four pound calibre, the constituent parts of which admitted of being dismounted and replaced at pleasure."

“In the arsenal of Paris are found two pieces—one a twelve, and one an eight pounder—constructed of tubes one within the other, secured by strong bands, and the whole welded together; and I am assured that we have in our own establishments two wrought-iron guns, light, and of perfect workmanship.”

“At the chateau of St. Dizier, a very old piece was found, of a calibre of twenty inches, and weighing seven thousand six hundred and sixteen pounds; the chase was made of wrought-iron, and the chamber and breech cast of the same metal. At Hartz, also, were some pieces, twelve and sixteen pounders, of wrought-iron, which do not appear to have been fabricated in the usual manner with bars and bands welded together, nor is the process known; they weigh about eight thousand pounds.”

Again,—“At Brest is a cannon taken from the English, weighing seven thousand seven hundred and twenty-three pounds, eleven feet one inch long, and of six inch calibre. The bore is made of seven bars of wrought-iron, secured by bands of the same metal.”—*Aide Mémoire*, vol. ii, page 784.

It appears that wrought-iron guns have been made from the earliest times, and were, until superseded by the introduction of cast-iron and bronze cannon, the principal artillery in use; that at different periods since the general use of cast guns, efforts to construct serviceable cannon of wrought-iron have been made by the principal European powers, and that, whatever may have been the cause, they have not been again employed in active warfare. The inference is, therefore, although no further information than the foregoing is in the possession of this bureau, that they have not been used for good and sufficient reasons.

The two wrought-iron guns on board the steamer “Princeton,” being the only guns of that description ever used in the navy, no opportunity has been afforded this bureau of ascertaining the relative strength and utility of wrought and cast-iron cannon.

All of which is respectfully submitted.

I have the honor to be, very respectfully, sir, your obd't. serv't.

W. M. CRANE.

Hon. John Y. Mason, Secretary of the Navy.

The Dipleidoscope.

Mr. Dent, the eminent chronometer maker of the Strand, had long felt persuaded that the interests of Horology would be greatly promoted, if the public could obtain a cheap, simple, and correct transit instrument, requiring little or no scientific knowledge for its right use, and not readily susceptible of injury, or derangement. To this end he devoted much time and thought; and, in 1840, he considered that he had succeeded in inventing an apparatus, which, by means of *shadows*, would produce the desired result. This idea he communicated to Mr. Bloxam, who thereupon informed him that his own attention had been for some years devoted to the same object, and

that he had contrived an optical arrangement, which, by the agency of a single and double reflection, determined the sun's passage over the meridian with great exactness. When the optical instrument, although complicate in its then form, was shown to Mr. Dent, he was immediately struck with the superiority of the contrivance over that which had suggested itself to *him*; his own method afforded three observations, but it was attended with the defects and inconvenience which result from the uncertainty of shadows. Convinced that the reflecting planes would effectually accomplish the desired end, he entered into an arrangement with Mr. Bloxam to undertake their manufacture; and, after nearly two years' attention on the part of that gentleman, and at great labor and expense on the part of the proposer, the instrument which we are about to describe was perfected, and may now be had at the trifling expense of two guineas.

The instrument possesses great advantages over any other of similar correctness; being exceedingly simple, it is not liable to get out of adjustment, or repair, nor does it require any attention beyond that which is, of course, necessary in the first instance, viz., that it be placed on a level surface, and in the meridian. The observations to be taken afterwards, can be made by any one, although previously unacquainted either with astronomical apparatus, or practical astronomy; the instrument being as simple as a sun-dial, while it is infinitely more correct, since it gives the time to within a fraction of a second.

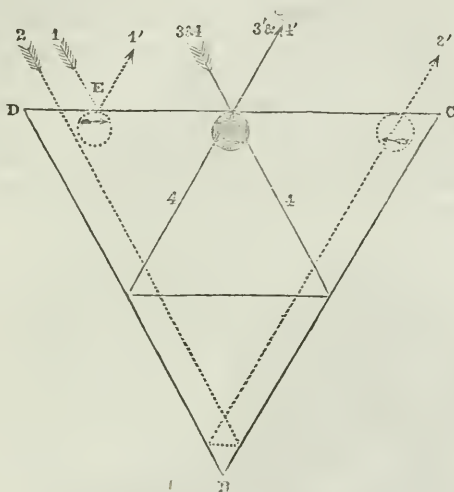
By the aid of this new patent meridian instrument, which is called the Dipleidoscope, any person may obtain correct time with the greatest facility, by an observation either of the transit of the sun over the meridian by day, or of the transit of the stars by night. In the following explanation, however, it is intended, for the sake of consulting both brevity and simplicity, to confine the directions to solar observation.

In the language of philosophy, the law which governs the transmission of light is, that the angle of the rays of incidence is equal to the angle of the rays of reflection. In other words, supposing the rays of light proceeding from an object to fall upon a reflecting plane, the eye of the observer must, in order to see the reflected image, be placed at precisely the same angle with regard to the plane, as the rays proceeding from the object to the plane. The rays falling upon the plane from the object are styled "the rays of incidence" as the rays again proceeding from the plane to the eye are termed the "rays of reflection." Keeping this law, or principle, in view, let us next consider the construction of the reflecting planes of the instrument in question.

There are three reflecting planes, D C, D B, and B C, fig. 1. Suppose D C, to be so divided that the ray No. 1, falling on D C, at E, will be reflected to the eye at 1', and the image of the sun will appear to advance in the direction from D to C. The ray No. 2, passing through D C, is reflected from C B; impinges on D B, and reaches the eye in the direction 2'. The image of the sun, thus formed, will appear to move from C towards D, because it has been *twice* reflected,

and thus the two images will *approach* each other. Suppose the ray No. 1, to have advanced to the position No. 3, and the ray No. 2, to the position No. 4, it will then be evident that their reflected rays will be in the same direction 3' and 4', and, therefore, that the two images of the sun coincide, as shown by the arrows being in the position of crossing each other, and indicating the instant of apparent noon; as the rays continue to advance, the images, having passed over each other, will, of course, be seen to separate.

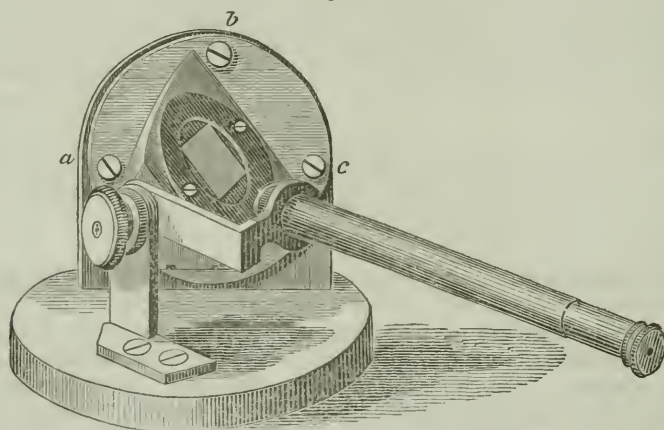
Fig. 1.



The following familiar illustration is introduced to further explain the optical construction. When the sun is about setting it is not uncommon to see the rays so reflected from the windows of a whole range of houses, as to convey the idea of a public illumination. While some portions of the sun's rays are thus reflected, other portions pass through the glass into the rooms. The rays thus transmitted (the rays of *incidence*, as they were styled above,) may be thrown at pleasure in any direction consistent with the range of the sun, by a person within the room, having a looking-glass in his hand: exactly as children produce what they call a *Jack o' lantern*. Now if, instead of throwing the rays upon a non-reflecting object (such as the wall, &c.,) he were to transfer them to another looking-glass, they would be again reflected from this latter glass. Supposing these two looking-glasses to be placed at an angle of less than 90° , in a manner corresponding with the position of the two silvered planes seen in the instrument, and also shown in the diagram at DB, BC, he can reflect the sun's rays again out of the window. Now, if we imagine the window to represent the outer reflector of the meridian instrument, its construction is, by this process, completely exemplified. To proceed a little further, it is evident, that the angle and situation of the two looking-glasses could be so arranged as to direct the rays of the

sun through any particular pane of the window; so that a person standing without, in a proper position, would see, in addition to the sun's rays reflected from the *outer* surface of the pane, the rays of incidence that had passed through the window, and were thus reflected from the double mirror. One of the luminous objects (the flash, or glare, of the sun,) so produced, would be reflected from the surface of the window, and would be a *single* reflection; while the rays of incidence, which had passed through the window, and undergone a *double* reflection by means of the *two* mirrors, would, on being thrown back by the mirrors through the window, move in a direction contrary to that taken by the single reflection from the surface of the window pane. Hence, any one of the heavenly bodies, subjected to the eye by a process of the above description, would not only appear as two distinct objects, but those objects would be seen to approximate and cross each other in an *opposite* course; a desideratum being hereby secured which increases the power of the instrument in a double ratio, and renders it proportionally preferable to any other that has been hitherto employed.

Fig. 2.



The wood-cut figure 2, represents a Dipleidoscope fitted up with a telescope, and having all the usual meridian and vertical adjustments, to be effected by means of the screws *a b c*. This form of mounting the instrument is suited to the observatory, or library, where it should be placed on a pedestal of stone, or cast-iron.

Civ. Eng. & Arch. Journ.

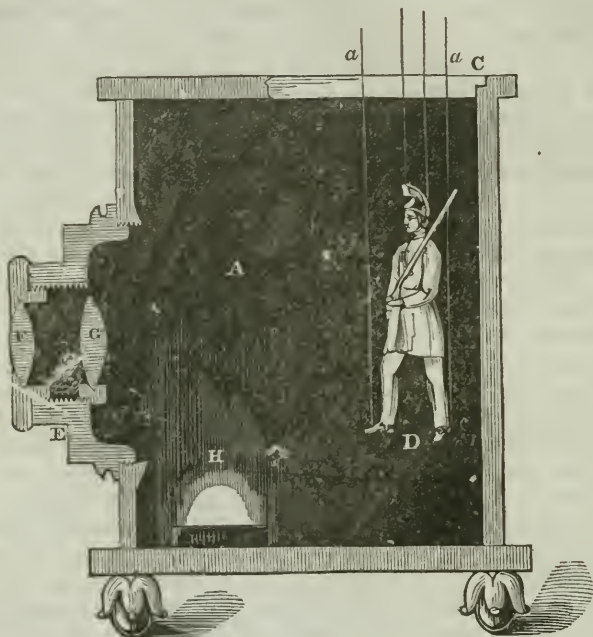
Robson's Patent Signal Lights.

A number of gentlemen connected with shipping, railway, &c., and several connected with the scientific improvements of the age, who had been present at the distribution of prizes at the Society of Arts in the morning, attended at Blackwall in the evening of Monday last,

to witness some experiments with these lights, as signals, which gave the most entire satisfaction as to their superiority over the simple blue lights hitherto used in the navy, or any description yet introduced. They are of three colors, red, blue, and green, the composition being chemically prepared, so as to retain their properties after any lapse of time, and in any climate. For vessels at sea, and steamboats in crowded rivers, this invention has achieved a desideratum long required, viz., the obtaining a vivid and intense light *instantaneously*, and lasting from three to five minutes, with as much ease as pulling the trigger of a pistol, or lighting a lucifer match. The whole apparatus is about five inches in length, consisting of a *papier maché* case, joined at bottom to a small cylinder of wood, in which is inserted a screw of about a quarter of an inch in diameter; on the top of the case is the chamber containing the chemical compound, and through its centre is placed a quick match; a tiny globule of glass, containing sulphuric acid, is placed in the wood cylinder, and beneath it a small cake, composed of oxymuriate of potash and sugar, (our chemical readers will be perfectly aware of the result of the union of these three substances,) a tin slide passing through a saw-cut in the wood, and separating them—thus rendering accidental ignition next to impossible. When the light is required, the tin slide is withdrawn, and a turn of the screw then breaks the globule, the sulphuric acid comes in contact with the oxymuriate of potash, flame is evolved, and, by the communication of the match to the compound in the chamber, the most brilliant light is instantaneously produced. An ingenious suggestion has been made by Mr. Whishaw, viz., the practical application of these lights to a universal system of *numeral* signals. He proposes the following motions:—For figure 1, move the white light up and down in a vertical direction; 2, move the white light in a horizontal direction; 3, the same light in a semi-circle; 4, red light vertically; 5, red light horizontally; 6, red light semi-circularly; 7, green vertically; 8, green horizontally; 9, green semi-circularly; 10, either light in a complete circle. This simple lesson, once generally understood, would be of the greatest advantage to ships at sea—a mode of communication of incalculable benefit in cases of fire in the metropolis and large town, between the members of the fire brigades, as well as for telegraphic purposes generally. The intensity of the light produced may be understood from the report of Mr. G. Atkin, experimental chemist, on one of the smallest lights, three inches long, and three-eighths of an inch in diameter, in which he states that by Wheatstone's photometre it was equal to eighteen of the best sixteen hole Agand gas burners now used. The invention has been adopted by the Lords of the Admiralty, the Post Office authorities, &c.; and, from the facility with which the light can be produced, the entire absence from all danger, and the economy in their use, they will, without a doubt, become an indispensable adjunct, under all circumstances where signal lights are required.

Description of the Spectroscope, a new instrument for exhibiting supernatural appearances, etc. By T. W. NAYLOR.

The annexed drawing represents the internal structure of an instrument, devised by me, for producing such supernatural appearances as skeletons, wraiths, &c., on the semi-transparent parts of a dramatic scene, as, for instance, on the "sky" of a landscape, the window of a hall, or chamber, or the "impenetrable gloom" portion, in the centre of some haunted cavern, or witches' cave.



A, is a square wooden box of about two feet six inches each way; it has an opening C, to which can be fitted the perforated lid; the holes in the latter are to allow the strings *a, a, a*, that work the automaton D, to pass through from thence to a wooden cross held in the hand of the exhibitor. E, is a brass piece, to which two convex lenses F and G, are screwed; the compound focus of which ought to be about two feet. H, is an iron tray, on which an ounce, or thereabouts, of the chemical mixture called "*Bengal fire*," is placed, a similar arrangement being made on the opposite side of the box.

When it is desired to put the instrument into action, it is drawn to such a distance from and behind the scene, that the image of the figure D, may fall thereon, and be shown distinctly; the stage is then darkened, either progressively, or suddenly, and the moment the Bengal lights are lit, the apparition will become visible to the spectators, producing quite a novel and peculiar effect, as the image has altogether a different aspect from any of those produced by magic lanterns,

or phantasmagoras; all of the latter having the appearance of mere superficial painted pictures, or transparent paintings, while the spectroscopic one resembles, in every point, a solid object, the projections, indentions, and shadows of the limbs, drapery, &c., being strictly those observed in nature, which gives it a very mysterious reality under the circumstances in which it is seen. The effect may be still further heightened by applying to the instrument the principle of the phantasmagoria; that is, the power of apparently projecting the images among the spectators. The emergence of a skeleton forms an admirable subject, and by fantastically moving its bones during the period of its dilatation, the effect is terrific in the extreme.

All the figures ought to be painted with white lead mixed with very thin size, in order that as much light may be reflected therefrom as possible; and the inside of the box should be covered with black velvet to prevent any false glare.

The Bengal fire mentioned above, is composed of purified nitre, eight ounces; brimstone three and a half ounces, red sulphuret of arsenic two ounces, all ground together in a mortar to a very fine powder, and afterwards put into a bottle, to preserve it from the air and moisture.

Lond. Mechanics' Mag.

Description of a Self-Registering Pendulum for indicating the inclination of Ships under sail, etc. By A. G. EYDE, Lieutenant Royal Navy.

The very rudely constructed instruments placed on board ships to ascertain the degrees of inclination under canvas, or from lurching in a sea way, caused me to give my attention to the subject, as far back as the year 1836, and I had an instrument constructed, on improved principles, with self-registering hands, so that the maximum inclination could at any time be known. This, in a dark night with heavy squalls where the attention of the officer of the watch is required to shorten sail, could not be obtained; but the self-registering pendulum may be referred to after all is made snug aloft, and the maximum degree of inclination may be obtained.

Several of these instruments have been made from time to time, and supplied to her majesty's ships, on the application of their captains for them; the general reports of their usefulness have been acknowledged.

Subsequently to this I have made still further improvements by adding a register to mark the number of oscillations a ship would make in a sea way; taking a starboard and port lurch to constitute a roll.

The advantages which suggest themselves in making these additions to the pendulum are as follows:—

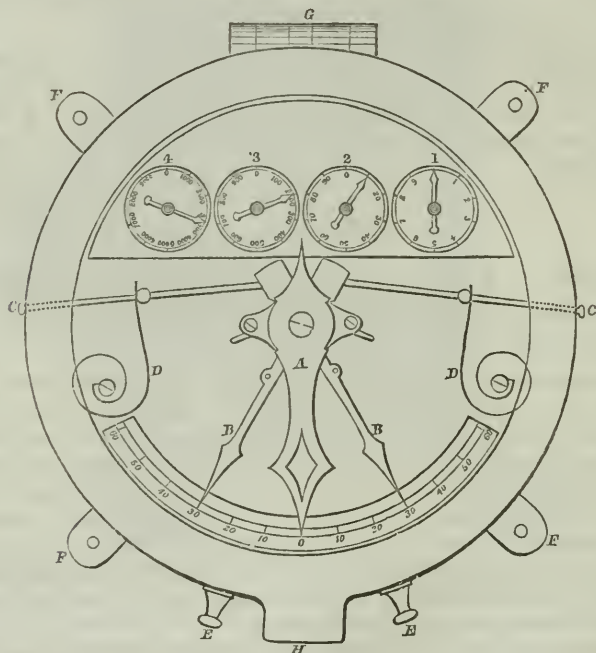
An accurate account of the stability of a ship, connected with the number of rolls made in a given space of time.

I apprehend if these instruments were supplied to an experimental

squadron of ships, their relative qualities could be much better obtained; at present we say one ship rolls more quickly than another, but our comparison may, in many cases, prove erroneous; but with the self-registering pendulum these requisites are actually pointed out, and relieve us at once of all doubts.

I would, therefore, submit that columns should be introduced in a ship's log book for registering the inclination and number of rolls made in every hour, or at any other convenient interval.

The accompanying sketch of the dial of the proposed pendulum will give some idea of it, but to draw plans and elevations of the machinery, at the back, sufficient to elucidate its construction would be occupying too much of your space; on which I fear I have already drawn rather largely.



A, the oscillating hand; B B, self-registering hands, moved by a pin at the back of A; C C, spring rods for resetting self-registering hand at zero; D D, springs attached to rods C C; E E, short bolts for securing the balance at the back, when the instrument is to be removed, or not required for use; F F F F, lugs for securing the pendulum to the wheel stanchion, or any other convenient place amidships; 1, 2, 3, 4, dials decimally divided, on which the number of rolls are registered; No. 1, having made one revolution, No. 2, marks one division, and so on with Nos. 3 and 4.

The figures represented by the dials are as follows:—beginning with No. 1, 10, 100, 1000, and 10,000. In reading off, therefore, if the number of rolls exceed 1000, we shall commence with No. 4, for

example, 3210, No. 4, will show on its dial 3000, No. 3, 200, No. 2, 10, and No. 1, at zero.

The whole is protected by a glass cover, G being the hinge, and H the lock.

Should you consider the foregoing description likely to prove interesting to any of your numerous readers, you will oblige me by giving insertion to it in one of your future numbers.

Lond. Naut. Mag.

BESSEMER'S Patent Gold Paint.

Since the appearance of this highly ingenious gentleman's specification, the writer has taken some little pains to hunt out whatever literary information is to be had upon the subject of *bronzes*, and has been surprised to find that little, or nothing, is to be found in books upon the subject. The writer has analyzed a specimen of rich copper colored bronze powder said to be of French manufacture, and he finds it is merely composed of copper and zinc, alloyed and colored by cinnabar in a state of extremely fine division. Some vegetable coloring material (lake, probably,) is also present. This bronze powder, therefore, seems to be only Dutch gold powdered and colored.

Before Bessemer's specification had been published, the writer had also analyzed his preparation, and found it to consist of

Copper,	.	.	.	.	77.50
Zinc,	,	.	.	.	21.91
Lead,	.	.	.	.	0.19
Tin,	.	.	.	.	Traces.
Iron,	.	.	.	.	0.21
					99.81
Loss,	.	.	.	.	0.19
					100.

The amount of iron present, which then surprised him, is now seen obviously enough to be derived from this mode of grinding the metals on steel surfaces.

The probable working proportion of the alloy is most likely 70 copper, and 30 zinc, the difference being volatilized (of the latter) in the fusion. The nearest atomic alloy to this is that ($3\text{ Cu} + \text{Zn}$) of 3 atoms of copper, and 1 of zinc, which is, by weight, 74.58 copper, and 25.42 zinc. This is the alloy of common rolled sheet brass.

In the proceedings of the Royal Irish Academy, for last year, will be found a paper by Mr. R. Mallet, of Dublin, describing the proportions of brass found in a very unusual state of aggregation, viz., ground under the brass bearing of a heavy shaft into an impalpable powder, precisely similar to Bessemer's, and afterwards aggregated, and become perfectly hard, coherent, and capable of being filed with metallic lustre, *but having a jet black fracture*; the aggregation

having been produced merely by great pressure, and at, or a little above, the temperature of the atmosphere.

In fact, there are few persons who must not have remarked the extreme state of division in which the metal of shafts, bearings, and wheels are occasionally abraded in contact with oil. The writer possesses cast-iron, thus levigated, from a pair of mitre wheels, as fine, unctuous, and soft, as black lead; and where power is cheap, it seems possible that a substitute for plumbago might thus be formed from cast-iron, of the softer and more carbonaceous sorts, to advantage. The Styrian irons, and Scotch ones, which are so soft, and rich in carbon, would answer best.

Bessemer's gold paint, owing to its extreme state of division, possesses also some remarkable physical properties. Thus, it is *apparently* perfectly infusible by the blow-pipe, or charcoal; the fact being that, while really in fusion, its minute particles have not sufficient mutual attraction to cause them to cohere, and form a fluid globule. They will not even cohere with the aid of a flux, such as borax; but if the red hot mass, which has been thus caused just to stick together, be suddenly dropped into a steel mortar, and struck while hot, (in the same way as Doctor Wollaston caused his platina powder to weld together,) it coheres, and now breaks with a distinct brassy fracture; and, on reheating, at once fuses into a fluid globule of brass.

There is no doubt but that, by severe pressure, and a gentle heat, this fine powder could be caused to aggregate and weld together like the metal described by Mr. R. Mallet, and thus afford proof that the *welding* property is not an exclusive one attached to iron, and doubtfully to platina; but that it belongs to all bodies that pass through an intermediate state of softness, of pastiness, between the solid and the fused conditions, and that its only essential other conditions, are pressure, and the mutual presentation of the particles to each other free from oxidation. This latter obtains in iron; though so oxidable a metal, in virtue of the great affinity of its oxides for silica, with which they form a fusible coating that protects the iron; and jet squeezes out from between the surfaces presented at the scaph.

But to return. The merit of Mr. Bessemer's patent gold alone can consist in the cheapness with which he can afford it; for as to the mode of using it in a fluid paint, the same may be done with any common bronze powder; but the fatal objection to the extended use of this material, either for in-door, or exposed, work, is that which equally affects the bronze powder, viz., that both are liable to the most complete and rapid deterioration of color, or even total destruction of appearance, by the reaction of those foreign bodies which the air of cities and lighted, or crowded, buildings contain in abundance. Thus, the writer finds Bessemer's gold is discolored instantly by sulphuretted hydrogen, or by ammonia, and rapidly by these bodies existing in common coal gas.

No external varnish seems to be capable of arresting the progress of these changes, which depend upon chemical affinities of great force, and in constant action.

The varnish sold with the gold paint appears to be nothing more

than fine spirit of turpentine mixed with a little varnish, or gold size. Turpentine varnish, diluted with spirit of turpentine, appears to do just as well.

R. M.

Lond. Mechanics' Mag.

New Safety Lamp.

At the last meeting of the Literary and Philosophical Society, Newcastle, Mr. Henry Smith, of that town, described a lamp invented by him, or, as it may rather be called, an improvement on Stevenson's lamp, still in part adhering to the principles of the Davy. By a careful consideration of the subject, Mr. Smith has come to the conclusion that more air is admitted in the Davy than is necessary to support combustion. Stephenson's lamp admits but a small quantity of air, and is thus easily put out by a change of position, or a current of air, and when the atmospheric air is deteriorated by the mixture of hydrogen, sufficient oxygen is not admitted, and the light is extinguished; it, therefore, shows when the air is impure, but so sensitively, that it is extinguished before any accident can occur. Mr. Smith's lamp resembles the Davy in the brass reservoir and top, and the same kind of wire gauze, but, in addition, at the bottom of the wire gauze, there is a hollow metal beading, which constitutes an air chamber, opening into which, from the outside, is a series of holes, so apportioned that the flame cannot go out until the air becomes too vitiated for a man to breathe in it; inside the wire gauze is a glass cylinder, with a copper top, perforated with holes; the gauze fits close to the copper top, and is held fast by a screw, which also carries the glass. In this lamp it will be seen that the flame could not ignite the inflammable gas outside, without passing in a downward direction through the gauze first, then the air chamber, and lastly, through the perforated head. The miner cannot light his pipe at the flame, the danger of ignition from particles of fine coal dust is avoided, and, should the glass be broken, the lamp is still a Davy lamp.

Ibid.

Easter Day, 1845. By A. DE MORGAN.

[The grave mistake which forms the subject of the following notice by Professor De Morgan, in the *Athenæum* of Saturday last, cannot be made too extensively, or too speedily, known.]

In an article which I have prepared for the next number of the "Companion to the Almanac," I have discussed the reasons why Easter Day will next year fall, in apparent defiance of the act of Parliament, upon the very day of the full moon. But as an accidental application which I have received (and I know that the superintendent of the Nautical Almanac has received another from a different quarter,) makes me think that the computers of almanacs will be puzzled, and that the useless discussion of 1818, (when the discrepancy last occurred,) will be revived, unless some one will forthwith state

the reason of the difficulty, I request that you will publish some of the conclusions of the paper to which I refer, which will in due time appear in the work cited. The rule adopted in this country for finding Easter, is that of the Roman Catholic Church, as established at what is called the reformation of the Calender by Pope Gregory XIII, in 1582. The authority for this rule is contained in the papal brief of March 1st, 1582, in which reference is made, for all explanations, to the then forthcoming work of the Jesuit Clavius, to whom both the adjustment and explanation of the calender had been intrusted. The British Parliament, in adopting the *rule* of Clavius, made two mistakes in the *explanation* of that rule. Their explanation is, that Easter Sunday is the Sunday after the full moon, which comes on, or next after, the 21st of March, and that if the full moon fall on a Sunday, Easter Sunday is the next Sunday.

The two mistakes are as follows:—

1. Instead of “full moon,” they should have said “fourteenth day of the moon, the day of new moon being reckoned as the first.”—That Easter, as well as the Passover, was always regulated, not by the full moon, but by the fourteenth day of the moon, is of the utmost historical notoriety. And Clavius says, that “none but a few who fancy themselves sharp sighted, ever imagined that the fourteenth of the moon and the full moon were the same in the Church of God.”

2. Instead of the “moon” of the heavens, they ought to have said the “moon of the calendar,” which is a very different thing. The moon of the calendar is not even a mean, or uniformly moving moon, to which astronomers refer the real moon, but differs from it intentionally and avowedly, by two classes of arbitrary alterations, the first class intended for simplicity of calculation, the second for avoiding the possibility of the Christian Easter falling on the actual day of the Jewish Passover.

In the year 1845, the fourteenth day of the *calendar moon* falls on Saturday the 22d of March, whence Easter is rightly made to be Sunday the 23d, according to the law both of the Roman and English churches, though the English statute does not well explain its own method. With regard to this country, it should be noticed that this statute enacts that Easter shall be kept by the “calendar, tables, and rules,” annexed to the act; and these agree with Clavius.

Of course any one is at liberty, as many did in 1818, to think that the statute should be altered; and certainly, it would be worth while to avoid misconception by repealing the faulty definition, and substituting a better one, in the prayer books of the Established Church. But if any one should wish to advocate the repeal of the rules, and the construction of new ones agreeable to the existing definition, and astronomically true, he will perhaps pause when he finds that his own system would *sometimes* cause it to happen that St. Paul’s Cathedral must keep Easter a week after Westminster Abbey, and would very frequently make a week’s difference between the festivals of the colonies, and the mother country.

University College, London, June 14, 1844.

Ibid.

A simple method of Tracing upon the surface of a cylinder Spirals of any given constant, or variable, obliquity. By Mr. ROBERT MALLET.

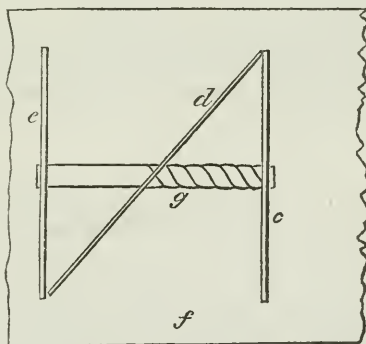
For many purposes of the arts a simple and rapid method of tracing spirals upon a cylindric surface is important; carvers, wood turners, &c., often want such, and in larger works, such as some particular branches of mill work and engineering, it is also frequently wanted.

The usual method, by dividing the cylindric surface into equal portions in circumference and length, and drawing diagonally is tedious. The following method, believed to be new, is simple and ready, and sufficiently exact for most purposes. Two straight edges of equal length and width, and about five-eighths of an inch in thickness each, are to be secured on a table, parallel to each other, standing on their edges, and distant from each other by nearly the length of the cylinder upon which the spiral is to be marked. Between these there is to be also secured, in a diagonal direction, stretching from one to the other, a third straight edge, formed of two slips of deal glued together, with a slip of straight cut thick Bristol board between them, projecting one-eighth of an inch at one edge. The section will then be thus—

Fig. 1.



Fig. 2.



The entire height of this from *a* to *b*, when standing on the table, must be a *shade* more than that of the two other straight edges. The three pieces being then thus arranged, the edge of Bristol board is charged with printer's ink. Then, on causing the cylinder to roll over the edges of the two parallel straight edges, in the direction of their length, the diagonal slip of inked Bristol board will trace a spiral upon the surface of the cylinder with very considerable accuracy.

Fig. 2, *c c*, the parallel straight edges; *d*, the diagonal tracer; *f*, the table; *g*, the cylinder, partly traced. The obliquity of the tracer with respect to the straight edges, will be an angle equal to that which the spiral at any point is intended to make with the axis of the cylinder. Hence, if the obliquity of the spiral, or pitch of the screw,

is to be variable, the tracer, in place of being straight, must be a curved edge, the angle formed with the straight edges (or rolling bars, as we may call them,) varying as determined.

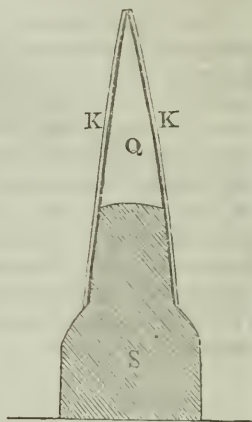
The length of the rolling bars will be equal to the circumference of the cylinder to be marked, as many times as the number of revolutions of the spiral.

Spirals may be marked on the surfaces of cones in this way, and the method is peculiarly applicable for marking on the large scale the trace spiral of screw propellers.

Fig. 3.

Polygonal prisms may also be so marked with spirals.

For marking upon metallic turned surfaces, the trace of large original screws, there must be substituted for the Bristol board tracer, one formed of two sheets of thin brass, meeting at an acute angle, and charged between with printing ink. While the upper edges of the rolling bars must be covered with a surface of buff leather, both to prevent slipping (for which end the metal surface and these should be chalked,) and to allow by compression of firm contact between the metallic cylinder and the inking tracing bar, which is like a sort of continuous drawing pen. In section thus: K K, plates of brass; Q, space for ink; S, wood base. I have found this simple arrangement useful on several occasions, and am anxious thus to make it more so.

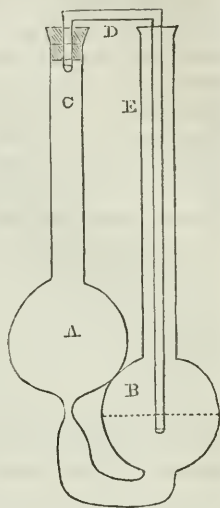


Ibid.

Apparatus for the analysis of Carbonates by ascertaining the loss of weight from the disengagement of Carbonic Acid Gas. By DR. URE.

A few years ago I had the following apparatus made for the ready analysis of carbonates, by ascertaining the loss of weight they suffered from the disengagement of their carbonic acid gas, during their solution in an acid. A B, are two globes of about two inches in diameter each; A, has its inferior neck strangled into a bore nearly capillary; B, stands lower, with its centre line on a level with the narrow neck of A. The tubes of these globes are about one-half inch in diameter. C, is shut at top with a perforated cork, through which enters, air-tight, a small glass tube, which is bent across to the mouth of the tube E, and then passes down into it a little below the centre line of the globe B. This globe is rather more than half filled with sulphuric acid, when the instrument is employed in the analysis of the carbonates. The standard weight of carbonate of soda = $24\frac{1}{2}$ grains, or of carbonate of potash = $31\frac{1}{2}$ grains, is then put into A, having previously laid a minute globe, or glass, over the lower orifice;

the cork, with its small tube, is now firmly adjusted, and the apparatus is weighed in its upright position, either by suspension with a hook to the end of the beam, or by resting it on the scale in a light socket of any kind. It is next laid hold of, and inclined so as to cause a little of the acid in B to pass over into A. Effervescence ensues with greater, or less, vehemence, according to the nature of the carbonate, and quantity of the acid introduced. Should it be too violent, and threaten an overflow by intumescence, it can be instantly abated to any degree by the slightest slope of the instrument. Now, this power of control forms the peculiar feature and advantage of this contrivance; whereas, in all other forms of such apparatus that I know, whether by sucking over, or pouring in, if a little too much acid comes upon the carbonate, the experiment is effectually marred. The gas disengaged in A, must necessarily traverse the sulphuric acid in B, and be stripped of its moisture before escaping into the air. Having supersaturated the alkaline base, and cooled the apparatus, we weigh it again, and the loss of weight in grains and tenths denotes the per centage of soda, or potash, provided their neutral carbonates had been the subjects of experiment. For limestone, on the same plan of computation, $22\frac{1}{2}$ grains may be taken. It deserves to be noted, that the present instrument has only one junction, and needs no chloride of calcium, a substance so apt, by its swelling, to burst the glass tubes that contain it.*



Lond. Journ. Arts & Sciences.

Steam Communication with France.

The Princess Mary steamer, which has been built for the South Eastern Railway Company, by Messrs. Ditchburn and Mare, and fitted with Messrs. Maudslay and Field's annular cylinder engines, made her trial trip on Wednesday, June 18. She left Blackwall at forty-three minutes past 10 o'clock, and arrived off the east end of the Isle of Sheppy (a distance of fifty miles,) at seven minutes past 2, being at the rate of sixteen miles an hour, against the tide the whole way. Every thing that could be desired concurred to give her an opportunity of testing her power; the, till now, fastest steamer, the Prince of Wales, leaving Blackwall some minutes before her; the Isle of Thanet also preceded her by twenty minutes; they were, how-

* 1000 water grain measures of sulphuric acid of specific gravity 1.032, or 32 above water, neutralize 32 grains of soda, and, consequently, one atom, on the hydrogen scale, of each of the other bases, reckoned in grains.

Having, in the course of many years, subjected my tables of sulphuric, nitric, and muriatic acids, as well as of ammonia, to strict cross examination, I have found them trustworthy for all alkalimetical and acidimetical purposes.

ever, both passed in gallant style at the point above stated, the Princess Mary crossing their bows, making a circuit around them, and returning on her homeward voyage. The Princess Mary, on the Boulogne station, must have immense influence in determining the continental traffic to the south-eastern line. There can be no doubt, from the known energy and skill of the directors of the railway company, that this important branch of the service will be thoroughly well done. The influence of the railway is already telling well in this particular. Ostend has the Princess Alice, Dover the Magician, Folkestone the Princess Mary; and we shall be much surprised if the latter do not bear away the palm from its competitors. The Princess Maude, another iron steamer, built for and by the same parties, and of equal speed, is expected to be completed for the Folkestone station, in a few weeks.

London Times.

Bronze.

The Chinese bronze copper in a very superior manner. This is the mode of the ancients for urns and other little vases and ornamented goods. After having rubbed the article with the ashes of coal and vinegar in such a manner that the copper is very shining, they dry it in the sun, then they cover it entirely with the following composition: two mace of verdigris, two mace of mineral cinnabar, two mace of sal ammoniac, two mace of the beak and liver of duck, five mace of alum, well pounded, well mixed, and moistened sufficiently to make a paste, which may be spread. (The *mace* is the tenth part of a Chinese ounce.) When the article is thus prepared it is passed through the fire, and washed when it is cold. It is covered a second time with this composition; it is then passed through the fire, and it is washed thus ten times. The small pieces thus bronzed, are of great beauty, and lose nothing by being exposed to open air and rain. —*Capt. Pidding's Chinese "Olio."*

ENGLISH PATENTS.

Specification of a Patent granted to HENRY AUSTIN, of the county of Middlesex, for a new method of Gluing, or Cementing, certain materials, for building and other purposes.—[Sealed 10th June, 1843.]

The cement used by the patentee is made by mixing India rubber with cold naphtha, in the proportion of eight ounces of India rubber, cut into small pieces, to each gallon of naphtha, stirring it from time to time until the India rubber is dissolved; then, to one part, by weight, of this mixture, two parts of lac are added, and the whole is thoroughly blended together by the application of heat, accompanied with occasional stirring. When greater elasticity is required, a larger propor-

tion of the India rubber solution is used; if greater hardness is necessary, a larger proportion of lac is employed; and where the India rubber would be liable to injury from great exposure and pressure, a much less proportion is used, and it is sometimes dispensed with altogether; asphalte, pitch, or resin, or other materials of that nature, may, in some instances, be substituted for the lac.

The materials for building purposes to which this cement is applied, are slate, tiles, stone, glass and metal plates. When being used, the cement is kept in a heated state in a dish, or vessel, containing a narrow trough, termed a stamper, which slides up and down therein, between guides; the slate, or other material, is brought to a heat of 150 Fahr., and placed upon the dish, and the stamper, being then raised, imprints, or stamps, a margin of cement thereon. The requisite margins of cement for forming overlapping joints being thus applied to the slate, or other material, the cemented portions, or margins, are laid in contact with each other, and in a short time become firmly united, forming water-tight surfaces. Sometimes, to expedite the process, a coating of naphtha, or other spirit that will act upon the cement, or a solution, made by dissolving the cement in naphtha, or other spirit, is applied to the cemented portions, or margins. The cement may also be used for securing the above materials to the building, as well as to each other.

The patentee connects pieces of glass together with the above cement, when making sky-lights, conservatories, frames for horticultural purposes, &c.; he also cements slate, stone, metal, and manufactured clays, and cements together, or to wood, or to woven, or other fabrics, or woven or other fabrics to wood, for building and other purposes; he likewise cements pieces of leather together, for making boots and shoes, and hose, or pipes, for fire engines; also, leather and cork together, or to wood, metal, or woven, or other, fabrics, and woven, or other fabrics, to wood, for the manufacture of trunks, portmanteaus, packing-cases, and other purposes. When joining these materials, the parts must be dry, and free from dust, and should be warmed previous to receiving a coat of the cement, in order that it may not be chilled at the moment of application. If the joint is to be made at once, the parts must be expeditiously put together, and pressed, as the cement rapidly loses its heat, and becomes solidified; but the junction may be effected at any subsequent period, by the application of heat, or the spirit, or solution before described.

The patentee claims, firstly, the application of caoutchouc (India rubber,) in combination with other materials, for the purpose of gluing, or cementing, together slate, tiles, stone, and metal plates, for roofing and other building purposes; and glass, for such building and other operations, as above described; secondly, the use, or application, of the above described cement, glue, or composition, for the purpose of gluing, or cementing, together the materials above mentioned, for building and other purposes.—*Enrolled in the Enrolment Office, December, 1843.*

Specification of a Patent granted to CHARLES TOWNEND, of Manchester, for an improved process, or manufacture, whereby Cotton Fabrics are aided and made repellent to water and mildew, and any unpleasant smell is prevented in such fabrics.—Sealed 6th March, 1844.

This invention is intended to be applied chiefly to fustian cloths, called “beverteens,” although it is also applicable to other cotton fabrics; it consists in rendering the fabrics repellent to water and mildew, and preventing any unpleasant smell, by steeping them in, or passing them through, the solutions hereafter described.

As the general practice of dyers is to mix their solutions, with reference to the weight of the cloth, or other material, to be immersed therein, and without regard to its length, or width, the patentee describes his process upon this plan; the quantities mentioned being calculated for fabrics, of which a piece, sixty yards long, and twenty-seven inches wide, will weigh forty pounds.

To prepare a solution in which the fabrics are to be immersed, the patentee proceeds in the following manner:—Twenty pounds of calcined British gum are mixed with eight gallons of cold water, in a suitable vessel, or vat, until fine and pasty; then ten pounds of palm, or white, soap are dissolved in eight gallons of boiling water, in another vessel, and this solution is added to the former, together with one pint of logwood liquor, and the whole is boiled up together; three pounds of rock alum, dissolved in one gallon of water, are then added, and the mixture, after boiling for a few minutes, is ready for use. The cloth, or fabric, (having been previously prepared and dyed in the ordinary way, is steeped in, or passed through, the above mixture, or solution, in the usual manner of stiffening and drying cotton fabrics.

Sometimes the patentee uses two solutions in succession, one of which is formed by boiling six pounds of sulphate of zinc in nine gallons of water, and, when cold, drawing off the clear solution; the other is made by dissolving twenty pounds of calcined British gum in eight gallons of cold water, and ten pounds of palm, or white, soap in eight gallons of boiling water, then mixing these two solutions, and, after adding a quarter of an ounce of pearl ash, bringing them up to a boiling heat. The cloth, or fabric, is first steeped in, or passed through, the zinc solution, and is immediately afterwards steeped in, or passed through, the other solution.—*Enrolled in the Rolls Chapel Office, May, 1844.*

Ibid.

Specification of a Patent granted to THOMAS MURREY GLADSTONE, of Wolverhampton, for certain improvements in machines for Cutting, or Shearing, Iron and other Metals, which improvements are applicable to other like purposes.—Granted December 28, 1843; Enrolled June 28, 1844.

This invention consists principally in the peculiar construction of

the shears, as will be seen by the accompanying drawings, and the following description; fig. 1, being an end view of a double cutting machine, and fig. 2, an elevation of one side thereof; *a*, is the foundation plate, and *b*, a standard cast upon it; *c* and *d*, are also two standards, dove-tailed into the foundation plate, and secured to the same by means of bolts; *e*, is the shear, the form of which will be seen in fig. 2, partly shown in dotted lines; this shear moves upon an axis *f*, which axis is supported by the standards *b* and *d*; *g*, is a projecting arm of the shear, to the end of which is attached one end of a connecting rod *h*, the opposite end being attached to some moving power; *i*, is a piece of metal attached to the shear, and forms part thereof; *k* and *l*, are two steel cutters, the former being fixed to the piece *i*, and the latter to the standard *c*.

Fig. 1.

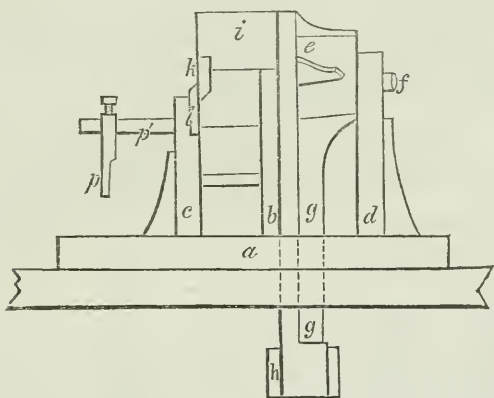
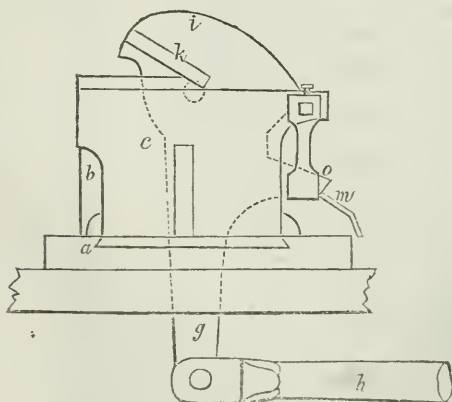


Fig. 2



In cutting, or shearing, a plate of iron, the plate is inserted at the front of the machine, and the strip of metal cut off, instead of curling up as usual, is kept down and straight by that part of the shear marked

i, coming upon it; and when the same is cut off it falls between the standards *c* and *b*, and upon an inclined plane *m*.

There is also another pair of steel cutters, one of which is attached to that part of the shear marked *o*, in figure 2, the other cutter being fixed to the inner face of the standard *b*; these cutters are intended to cut up the strips of metal into pieces of any desired length, which may be regulated by the sliding stop *p*, which is made to fit upon a bar *p'*, fixed to the side of the machine, the strips of metal to be cut up being inserted into the machine crossways. Civ. Eng. & Arc. Journ.

Lunar Occultations.

Lunar Occultations visible in Philadelphia, computed by MRS. CHARLOTTE S. DOWNES, from the Elements published with the Occultation list for the United States Almanac.

The Immersions and Emersions are for Philadelphia, mean astronomical time. Im. for Immersion, Em. for Emersion. These abbreviations in *Italics* refer to those Immersions and Emersions which take place on the Moon's dark limb. N. App. for Near Approach.

The angles are for *inverted image*, or as seen in an astronomical telescope, and reckoned from the Moon's North point and from its Vertex around through East, South, West, to North and Vertex again. For direct vision add 180°.

DECEMBER, 1844.

Day.	H'r.	Min.	Star's name.	Mag.	From North.	From Vertex.
2	10	11	Im. <i>u</i> Leonis,	6	127°	174°
	11	0	Em.		271	320
2	10	57	N.App. 57 Leonis, <i>u</i> N. 3'.	7		
14	5	24	Im. 44 Aquarii,	6.7	26	14
	6	7	Em.		271	259
14	7	28	Im. Bessel,	9	72	35
	8	36	Em.		232	187
14	9	31	Im. Bessel,	9	46	358
	9	51	Em.		263	214
14	9	51	Im. <i>g</i> Aquarii.	6	31	344
	10	40	Em.		280	229
15	5	36	Im. Bessel,	7	64	59
	6	58	Em.		232	207
15	8	30	Im. Bessel,	9	21	340
	9	23	Em.		284	238
15	8	30	Im. Lalande,	9	133	92
	9	5	Em.		172	129
15	8	54	Im. Bessel,	8.9	97	55
	9	50	Em.		211	164
16	5	8	Im. Bessel,	9	66	84
	6	32	Em.		229	221
16	7	32	Im. Bessel,	9	55	30
	8	52	Em.		247	206
16	9	17	Im. Bessel,	9	63	19
	10	28	Em.		248	199
16	9	23	Im. Bessel,	9	66	23
	10	35	Em.		244	195
16	12	20	Im. Bessel,	9	94	44
	13	11	Em.		229	180
20	4	40	Im. 54 Arietis,	6.7	42	87
	5	42	Em.		277	329
22	13	18	Im. <i>i</i> Tauri,	4.5	87	36
	14	35	Em.		285	230
23	3	26	Im. <i>g</i> Tauri,	3.4	84	127
	4	19	Em.		266	315
28	17	47	Im. <i>c</i> Lextantis,	6	82	56
	18	48	Em.		339	301

JOURNAL
OF
THE FRANKLIN INSTITUTE
OF THE
State of Pennsylvania
AND
AMERICAN REPERTORY.

DECEMBER, 1844.

CIVIL ENGINEERING.

Report on the Atmospheric Railway. By JOHN LEONARD.

TO THE COMMITTEE OF MANAGEMENT OF THE CROMFORD AND HIGH PEAK RAILWAY.

Gentlemen,—Agreeably to the instructions which I received at the meeting, held on the 7th of March last, I proceeded shortly afterwards, accompanied by Mr. Brittlebank, to Dublin, to examine the atmospheric railway between Kingstown and Dalkey, and to ascertain whether, or not, the principle might be applied with advantage to our inclined planes. In our investigation we received every attention from the gentlemen connected with the undertaking, and were not only allowed to examine every part of it minutely, but were also furnished with every information derived from their own experience.

For the information of those gentlemen who may not be conversant with the principle of the invention, I will explain its peculiarities in contrast with those of other railways, as carried out, and in daily operation at Kingstown. On ordinary railways, the train, or load, is moved along by means of an engine attached thereto, and moving with it; on the contrary, on the atmospheric principle the load is moved by means of a *stationary* engine, at a considerable distance from, and totally unconnected with it; differing, however, not only from railways where the locomotive engine is used, but also from those on which the stationary engine is the propelling power; inasmuch as the rope is entirely dispensed with, and its place supplied by

the pressure of the atmosphere. This, therefore, forms the peculiar feature of the system, and constitutes the difference between it and all other modes of propulsion on railways.

The means by which the principle is put in practice, are simply these :—

Between the rails, and along the entire length of an ordinary single line of railway, a pipe is laid of, say, fifteen inches diameter. This is connected at one end by a steam engine, the power of which is applied to a large air pump, which, being set to work, pumps out, or exhausts, the air from the interior of the pipe. Within this pipe is a piston, or plug, which works freely along its entire length; but, nevertheless, so tight that but little air can pass from one side to the other. This being so far understood, it is clear, that by pumping out the air from the *front* side of the piston, the pressure of the atmosphere on the *back* of, or behind it, will force it forward with a velocity dependent, 1st, on the degree of rarification of the air in front of the piston; 2d, on the weight of the load to be drawn; and 3d, on the inclination of the railway. The great difficulty, however, and that which yet remains to be explained, is, how to communicate the power which is *inside* the pipe, to the load which is *outside*. To accomplish this, there is a longitudinal opening, or slot, on the upper side of the pipe, which is continued throughout its entire length. In this opening there is a bar of iron, which is attached *below* to the piston within the pipe; and *above* to the leading carriage of the train, or rather one used exclusively for that purpose, to which the train is attached, so that if the former moves along the latter must move with it. It is evident, however, that during the time the engine is at work, exhausting the air from the pipe, the opening, or slot, of that portion of it, which is between the engine and the piston, must be closed perfectly, or as nearly as possible, air-tight, otherwise a vacuum could not be formed. This is effected by means of a leather valve, hinged on one side of the opening, over which it falls, and extending its entire length, perfectly covers and closes the whole of it. This valve is covered with iron plates both on its upper and under sides, for the purpose of strengthening it, and is rendered more perfectly air-tight by means of a composition of wax and tallow, into which the outer edge falls when closed. A heater attached to the carriage completes the process by melting the composition as it runs along its surface, and effectually seals it in readiness for re-exhaustion.

There are other valves, but of a different description, which close *across* the pipe, and by means of which it is separated into divisions; one of these is placed at that end of the pipe which is opposite to the engine, so that when closed, the pumping can commence, and a vacuum be formed at any time, so as to be in constant readiness. When the train is about starting, and the air-pump has produced a sufficient vacuum, as indicated by the barometer, the traveling carriage, with the train attached, is moved by hand until the piston enters the open end of the pipe, within a short distance of which the *closed* separating valve is placed. This valve, immediately on the entrance of the piston, falls down, by means of a self-acting apparatus, and the pres-

sure of the atmosphere is instantly transferred from it to the piston, and motion forthwith commences.

During the passage of the train, the longitudinal leather valve has to be raised, or opened, to allow the bar before spoken of, as connecting the piston *within* the pipe to the train on the *outside*, to pass: this is done by means of a roller attached to the piston frame, within the pipe, which is placed a little in advance of the bar, but behind the piston, and which, as it passes along, raises the valve just sufficient to allow the bar to pass, which being done, the valve falls into its place again, and is immediately pressed down by another roller which follows for that purpose; the heater follows and seals the composition, and the whole is then ready for the next train.

The atmospheric railway, at Kingstown, is $1\frac{1}{4}$ miles in length, and, in that distance, rises, by variable gradients, 91 feet, which is equal to 1 in 115, or about 52 feet per mile. It has a main, or pipe, of 15 inches diameter, and is exhausted by an air-pump of 67 inches diameter, and $5\frac{1}{2}$ feet stroke; worked by a steam engine of 100 horse power, making about 20 strokes, and discharging upwards of 5000 cubic feet of air per minute. The degree of exhaustion varies with the load; but for ordinary passenger trains it ranges on the barometer from 12 to 16 inches of mercury, which is equivalent to a pressure of from 6 to 8 pounds per square inch. The trains weigh from 15 to 20 tons, and the time occupied in working the engine for each is about 6 minutes; that is, $2\frac{1}{2}$ minutes in exhausting the main, and $3\frac{1}{2}$ in working the train up the $1\frac{1}{4}$ miles. Hence, the mean rate of traveling is about 30 miles an hour, but the greatest speed occurs about the middle of the journey, at which point the train moves at a rate of 40 miles an hour. The railway does not appear to be by any means adapted for high velocities, there being curves upon it which have a radius of not more than 500 feet; but this I believe was unavoidable, the railway having to follow the line of an old tram road, which had been used for the conveyance of stone from the quarries at Dalkey; as a mere experiment, however, it is valuable, inasmuch as it proves that curves of so short a radius may be traversed at a speed of from 30 to 40 miles an hour without danger.

Without entering into the subject of the atmospheric railway, beyond the legitimate object which we have in view, I may here remark that the application of the principle to a long, single line of railway, with an extensive, irregular, and miscellaneous traffic, would appear to me, in the present state of our knowledge of its capabilities, an experiment of doubtful success; confined, however, to such lines as would not require that trains should be traveling in opposite directions at the same time, and to situations where good locomotive gradients could not, at a reasonable expense, be obtained; the invention offers advantages which are not found in, nor could be accomplished so well, so safely, or so economically by any other with which we are at present acquainted. But, before making any further remarks on this part of the subject, I will proceed in considering it with reference to its application to our inclined planes.

In order to shorten and simplify the inquiry, I purposely omitted

entering upon anything which might be considered as common to both systems, and confined myself to those points only in which they might be expected to differ. Limiting my investigation, therefore, exclusively to the mode of applying the power, I directed my attention, first, to its mechanical practicability; secondly, to the comparative loss of power; thirdly, to the working expenses, wear and tear, &c.; fourthly, to the requisite permanent outlay; and lastly, to its comparative advantages and disadvantages.

As regards the first subject of inquiry, namely, its mechanical practicability, I found that the working parts of such as are most subject to wear, were, by no means, of a complicated character, nor such as would require either elaborate workmanship, or other than the most common materials in their construction; consequently, neither from their form, or material, are they such as, under ordinary circumstances, would easily be deranged, or soon worn out, or require other than common workmen and laborers for their repair, renewal, or management.

Exclusive of minute details, the only parts subject to wear are the piston, and the valve which covers the pipe; the latter being merely a strip of leather between iron plates, protected from the influence of the weather by the composition of wax and tallow, and merely raised a little out of its place once for each train, can scarcely be said to be subject to wear of any kind. The same may almost be said of the piston, which is simple and strong, and requires no further attention than the application of a little grease occasionally, and the renewal once a week, or so, of the leather packing, which can be done by an ordinary workman, or even an intelligent laborer. On the whole, therefore, there is nothing whatever in the system which would require a superior description of men to those which we now employ, nor any thing which they could not comprehend and manage as well as their present employment.

The second object of my inquiry, and one which I considered of great importance, was to ascertain the precise loss of power from leakage. I was the more anxious for satisfactory information on this head, because the substitution of a rope of air, for one of hemp, or iron, has been much dwelt upon, and the difference of their weight and friction considered as an addition to the net available power; but however plausible this may appear, it is possible that a loss of power may arise to as great an extent from pumping out the superfluous air from a pipe, as in moving a heavy chain, or rope; and if it should be found that the loss from leakage in the one case is equal to the loss from friction in the other, it would be evident that in this respect no advantage would be gained by one as compared with the other. The loss from leakage on the atmospheric system, (supposing the permanent joints to be perfectly tight,) can only arise, first, from the longitudinal valve; second, from the traveling piston; and third, from the air-pump piston.

The loss from the latter, whatever its amount, which, however, cannot be great, is permanent and irremediable. That arising from the traveling piston, is also, to a certain extent, permanent, but less in

proportion as the velocity increases, and the degree of exhaustion is diminished, while that from the longitudinal valve, which I consider the source of by far the greatest part, is proportioned to its length, and the degree of exhaustion of the main, diminishing, of course, as the piston approaches the engine; the loss, however, from this cause depends much on the attention paid to the state of the valve, and the sealing composition. On our inclined planes the loss of power which arises from the weight and friction of the chain, and other causes, amounts to about thirty per cent.; and, judging from information which I obtained at Kingstown, that arising from leakage on the atmospheric system, is as nearly the same as possible. The estimate of the loss is confirmed by some experiments made by Mr. Stephenson, the particulars of which were given me by the engineer of the railway, in one of which the loss from leakage was 33 per cent., and in the other 25 per cent. Hence, I was induced to conclude that the loss of power, whether caused by friction in the one case, or by leakage in the other, is as nearly as possible the same in both.

We are now come to the third subject of inquiry, namely, the working expenses, wear and tear, &c. On our inclined planes we have seven miles of chain in work, weighing 70 tons, which last, on an average, four years, and cost about £18 per ton; 70 tons £ s. d. at £18 per ton, amounts to £1260, which divided by 4 gives an annual expense for chains, of

315 0 0

We have also about 1500 pullies, or rollers, which weigh $\frac{3}{4}$ cwt. each, cost £10 per ton, and last about 7 years.

Hence 1500 rollers at $\frac{3}{4}$ cwt. each, weigh 56 tons, which at £10 per ton, amounts to £560, and divided by 7, gives an annual expense of

80 0 0

Axles, wood bearings, &c.,

10 0 0

Sundries, such as large wheels, chain wheels, segments, preventers, tackling chains, shackles, coal, tools, damage, &c.,

100 0 0

Wages, estimated at

100 0 0

£605 0 0

In ascertaining the working expenses of the atmospheric railway, I was assured by the gentleman who superintends it, that the amount was so trifling that it might almost be left entirely out of the calculation; indeed, from the remarks already made with regard to the wear and tear, it will be inferred that it cannot be large. The patentees allow in their estimate £50 annually per mile, for the renewal of the traveling apparatus. If, therefore, we take this sum and £25 additional for piston leathers, grease, and sundries, we shall probably have the annual cost sufficiently near for our purpose. £75 per annum, therefore, on $3\frac{1}{4}$ miles, will amount to £262 10s., which, exclusive of the interest on the permanent outlay, shows an annual saving on the atmospheric system of upwards of one half.

I have purposely left out of the calculation every thing relating to wages; because, not only the same description, but also the same number of men would be employed in one case as the other. Pro-

ceeding with our inquiry, our next object is to ascertain the amount of permanent outlay which would be required in changing from one system to the other. Our inclined planes are nine in number, and together are $3\frac{1}{2}$ miles in length. Their inclinations vary from 1 in 6 to 1 in 16; hence, the atmospheric mains necessary to enable us to draw the same weights, as we now do, must, in one case, be 27 inches, and in the other 17 inches diameter. The air-pumps being proportionate to the power of the engines, would, for the greatest, be 44 inches, and, for the least, (leaving out the small engine at Whaley) 32 inches diameter. The estimates of the patentees show that a main of 15 inches diameter, laid down and ready for use, would cost £3350 per mile, and with the air-pump £3600. But much of the cost depends on the weight of material; and, as ours would require to be at least one-half heavier, in consequence of their increased size, we could not safely estimate the cost at less than £5000 per mile, which for $3\frac{1}{2}$ miles would amount to £17,500. The interest on this sum at 5 per cent., would be £875 per annum, and added to the working expenses, wear and tear, &c., amounting to £262, would give the annual cost of the new system *to us* at £1137, instead of £600, as on the present plan.

It is clear, therefore, that whatever might ultimately be *gained*, nothing could be *saved* by the change; while for any *uncertain* advantage which might be expected to result from it, we should have a *certain* increased expenditure to the extent of, at least, £500 a year.

It now only remains that we should compare the advantages and disadvantages of the two systems; and, with this view we have to inquire in what other respect the introduction of the atmospheric principle would be beneficial.

The only object of importance which we should gain by the change would be *safety*; and although I am well aware of the value of perfect security in working inclined planes, I am nevertheless of opinion, that for a mere merchandize traffic, the outlay of eighteen, or twenty, thousand pounds is considerably more than the object is worth; besides, so far as relates to the safety of goods, we are now nearly as free from accidents, and damage arising therefrom, as we should be under any system.

If to this we add that under the atmospheric system we should be subject to inconveniences, which we do not now experience, it will tend further to show, that for a merchandize traffic, we are best as we are. The inconveniences alluded to would arise in this way: whenever a train of four, or more, wagons arrive at our inclined planes, they are, if loaded, drawn up in pairs, and as soon as one pair has reached the top, the other is immediately hung on at the bottom and drawn up without any further loss of time; but on the atmospheric system, the train would be obliged to wait until the engine had exhausted the main, unless it had been prepared in readiness; and, when the first wagon had been drawn up, the next would not only have to wait until the main had been re-exhausted, but also as much longer as would be required for the descent of the traveling

apparatus; making together, not less than six minutes delay between each pair of wagons, in addition to the time occupied in their ascent. The same kind of delay would occur to the descending wagons, with this additional disadvantage, that in order to raise the traveling apparatus between the descent of each pair of wagons, the engine must be kept in constant work; the same for downward as for upward traffic, causing thereby a considerable extra expense for coal and other requisites.

There are a few other inconveniences which would result from the change; but those which I have already pointed out, being of the greatest importance, and also quite sufficient to show that the application of the principle to our inclined planes, is, by no means, desirable, it is needless now to mention them.

From the preceding remarks it will, I think, appear evident, that the application of the atmospheric principle to our railway in its present state, so far from being any advantage, would, in fact, subject us not only to serious inconvenience, but to considerable additional expense, and that too, (so far as relates to our present traffic,) without any compensating benefit. It, however, by no means follows, that the principle cannot, under any circumstances, be applied with advantage; on the contrary, I am of opinion that it is peculiarly applicable to the circumstances of our railway, if properly carried out.

Railway Office, Cromford, July 1st, 1844.

Civ. Eng. and Arch. Journ.

A review of the circumstances which have affected the Consumption of Fuel in the Locomotive Engines of the Liverpool and Manchester Railway, from the opening to the present time. By EDWARD WOODS, C. E.

This is an excellent practical paper, probably the very best with which Mr. Weale's quarterly budget has yet furnished us. The importance of the inquiry to which it is devoted, is sufficiently attested by the simple fact, that it has for its object to give the why and wherefore, of the consumption of fuel on the Liverpool and Manchester line, having been reduced (with an increase rather than reduction of traffic,) from 12,604 tons in 1838, to 3103 (!) in 1843. Mainly, this has been owing to a progressive increase from $\frac{1}{16}$ th inch to 1 inch in the extent of the *lap*, (as it is technically called) or space by which the sliding valve overlaps at each end the steam ports (when placed exactly over them,) and to the greater rapidity with which the waste, or used, steam is thus enabled to escape from behind the piston. The *rationale* of this result is made exceedingly clear in the following extract:—

“Alternately to fill and empty the cylinder of its contents, are operations requiring *time*. The time allowed for the first operation, that of filling the cylinder with steam, necessarily corresponds with the duration of the stroke, whatever its duration may be. But this cannot be the case as regards the second operation, the emptying of

the cylinder. This ought to be performed in an instant, in the twinkling of an eye, in the minutest fraction of the duration of the stroke, otherwise the steam would continue pent up when it ought to be liberated,—when it ought to assume its minimum pressure, the pressure of the atmosphere,—and would exert an injurious counter pressure against the piston, tending to increase the resistance to be overcome.

“To effect the free and rapid discharge, it is necessary, not merely to open the communication to the exhausting pipe, but to open a *wide* passage, and to have this *done* by the time the piston recommences its motion. The valve alluded to (the old one used until 1838,) cannot accomplish this. Its motion is gradual, not instantaneous. The passage only begins to open when the piston is on the turn, and is not wide open until the piston has traveled through one-tenth of its entire stroke. The steam in the cylinder, is, consequently, restrained from escaping, being wiredrawn in the passage out, and, consequently, takes *considerable time* to assume the pressure of the atmosphere.

“In the meanwhile the new stroke has begun, and been partially completed, and so far the piston has had to contend with a resistance altogether illegitimate, a resistance which, in many cases, and especially at high speeds, has been equal to the sum of all the other resistances put together.”

The merit of first getting rid of this illegitimate resistance is ascribed to Mr. Dewrance, of the Liverpool and Manchester line:—

“The next important improvement in the valves is due to Mr. Dewrance, and was suggested by him early in the year 1840. His principle was, that the exhausting passage, instead of being only partially open at the moment of completing the stroke, as was, more or less, the case with the engines before named, should be nearly wide open, which was to be accomplished by making the ‘lap’ of the valve equal to the width of the steam port;—moreover, that the travel of the valve should be made proportionate to the increased lap, so as to allow the same area, or the same amount of opening of the steam port for the admission of steam. A favorable opportunity occurred for carrying out these ideas, both as regarded increased lap and increased travel, from the circumstance of two engines requiring extensive repairs, which would allow time for the needful alterations. One inch lap was given to the *Rapid’s* valve, which was now made to travel $4\frac{1}{4}$ inches. The result of this arrangement was, that the exhausting passage was one inch open at the end of the stroke, and that, supposing the stroke of the piston divided into 100 equal parts, the steam was cut off at 79; it expanded from 79 to 95; at 95 it began to be released, and was escaping into the atmosphere from 95 to 100. The *Rapid’s* gross average consumption of coke, when running sixty-four trips of 30 miles each with coach trains, *before* the alteration, was 36.3 lbs. per mile, and 28.6 lbs. per mile immediately *after* the alteration. Thus we have a measure of the effect produced—a saving of one-fourth of the fuel.”

Mr. Wood gives the following valuable summary of the work

done, coke consumed, and loads carried, by the several classes of engines on this line for the last four years. It deserves, and, we doubt not, will receive the earnest attention of all other railway companies.

GROSS CONSUMPTION OF COKE.

Passenger Engines.

Coke.

					Tons.	cwt.	qrs.	Per mile
$\frac{1}{2}$ year end'g	June,	1840	3463	Trips, 30 miles	1523	16	3	=32.9lbs.
	December,	"	3596	"	1276	9	1	=26.5
	June,	1841	3493	"	1036	15	3	=22.1
	December,	"	3496	"	958	19	0	=20.5
	June,	1842	3655	"	853	3	3	=17.4
	December,	"	3526	"	684	9	2	=14.5
	June,	1843	3243	"	646	1	1	=14.9
	December,	"	3555	"	717	2	2	=15.1

Average loads,
7 coaches.

Luggage Engines.

$\frac{1}{2}$ year end'g	June,	1840	1925	"	1160	12	3	=45.0lbs.
	December,	"	1653	"	867	9	3	=39.2
	June,	1841	1640	"	749	0	1	=34.1
	December,	"	1370	"	531	17	1	=29.0
	June,	1842	1604	"	559	2	2	=26.0
	December,	"	1521	"	421	17	2	=20.7
	June,	1843	1588	"	441	7	2	=20.7
	December,	"	1605	"	451	12	2	=21.0

Average loads,
22 wagons.

Bank Engines.

$\frac{1}{2}$ year end'g	June,	1840	349	Days.	486	11	3
	December,	"	356 $\frac{1}{4}$	"	369	10	0
	June,	1841	349 $\frac{1}{2}$	"	343	3	2
	December,	"	341 $\frac{3}{4}$	"	251	11	0
	June,	1842	361	"	174	6	3
	December,	"	363 $\frac{1}{2}$	"	143	13	3
	June,	1843	452 $\frac{1}{4}$	"	162	8	3
	December,	"	517 $\frac{3}{4}$	"	183	12	2

Coal and Ballast Engines.

$\frac{1}{2}$ year end'g	June,	1840	436 $\frac{1}{4}$	"	489	4	0
	December,	"	370	"	344	17	3
	June,	1841,	334	"	325	4	2
	December,	"	351 $\frac{3}{4}$	"	312	4	2
	June,	1842,	407	"	313	3	2
	December,	"	443 $\frac{3}{4}$	"	243	3	3
	June,	1843,	306 $\frac{1}{2}$	"	226	5	0
	December,	"	398 $\frac{1}{4}$	"	274	13	3

Average load,
15 wagons.

General Result.

In the year	1838,	12604	tons of coke consumed.
	1839,	11754	"
	1840,	6518	"
	1841,	4508	"
	1842,	3393	"
	1843,	3103	"

Mr. George Stephenson's account of himself.

This eminent engineer, at a recent entertainment at Newcastle, gave the following account of himself:—"The first locomotive that I made was at Killingworth colliery, and with Lord Ravensworth's money. Yes! Lord Ravensworth & Co., were the first parties that would intrust me with money to make a locomotive engine. That engine was made thirty-two years ago, and we called it 'My Lord.' I said to my friends that there was no limit to the speed of such an engine, provided the works could be made to stand. In this respect great perfection has been reached, and in consequence a very high velocity has been attained. In what has been done under my management, the merit is only in part my own: I have been most ably seconded and assisted by my son. In the earlier period of my career, and when he was a little boy, I saw how deficient I was in education, and made up my mind that he should not labor under the same defect, but that I would put him to a good school, and give him a liberal training. I was, however, a poor man, and how do you think I managed? I betook myself to mending my neighbors' clocks and watches at night, after my daily labor was done, and thus I procured the means of educating my son. He became my assistant and my companion. He got an appointment as under-reviewer, and at nights we worked together at our engineering. I got leave to go from Killingworth to lay down a railway at Hetton, and next to Darlington; and after that I went to Liverpool, to plan a line to Manchester. I there pledged myself to attain a speed of *ten miles an hour*. I said I had no doubt the locomotive might be made to go much faster, but we had better be moderate at the beginning. The directors said I was quite right; for if, when they went to Parliament, I talked of going at a greater rate than ten miles an hour, I would put a cross on the concern. It was not an easy task for me to keep the engine down to ten miles an hour, but it must be done, and I did my best. I had to place myself in that most unpleasant of all positions—the witness box of a parliamentary committee. I was not long in it, I assure you, before I began to wish for a hole to creep out at. I could not find words to satisfy either the committee, or myself. Some one inquired if I were a foreigner, and another hinted that I was mad; but I put up with every rebuff, and went on with my plans, determined not to be put down. Assistance gradually increased—improvements were made every day—and to-day a train, which started from London in the morning, has brought me in the afternoon to my native soil, and enabled me to take my place in this room, and see around me many faces which I have great pleasure in looking upon."

Lond. Athenæum.

Suspension Bridge over the Danube.

Mr. Tierney Clark, the engineer and constructor of Hammersmith

bridge, is about adding another laurel to his fame in this kind of architecture, by the completion of a most stupendous bridge across the Danube, the foundation of which was laid with much ceremony, by the Arch-Duke Charles, (as representative of the Emperor of Austria,) in August, 1842. The difficulties of constructing a bridge across this deep and rapid river have been long considered insurmountable; the lowest depth of water is always above twenty feet,—and in March, 1838, the river rose thirty-six feet above low water mark, breaking down the embankments placed to keep it within its limits, leveling houses, and destroying life to a great extent. The continual fluctuations of such a river, and the breaking up of the ice in winter, often forming immense masses a mile in length, and eleven feet high, will give some idea of what the engineer has had to contend with; he has, however, by the erection of the most stupendous coffer-dams and ice-breakers ever known, overcome every impediment—the gigantic work is fast approaching to completion—and its successful progress, by English talent and English workmen, in, to them, a rigorous climate, will prove another monument of the superiority of British scientific and mechanical skill, and a source of perplexing annoyance to our detractors. Some idea of the magnitude of one of the coffer-dams (that for the retaining pier on the Pesth shore,) may be formed from the fact, that five thousand persons were admitted within its area to view the ceremony of laying the first stone. The following are full particulars of dimensions, &c., of the bridge:—Distance between points of suspension 665 feet; two side openings each 297 feet; width of platform 42 feet—to be supported by cast-iron beams in one piece; height of platform above low water 50 feet. The suspension piers, or towers, are 150 feet in height from the foundations, of solid masonry, being faced with granite to the level of the roadway—the workmanship of the granite is of the finest description; the stone is brought from the granite quarries of Manthausen, in the neighborhood of Lintz, and distant from Pesth about 300 English miles—many of the stones weigh from ten to twelve tons. The coffer-dam for the second suspension tower, which has been the most difficult to accomplish, has just been completed, and when cleared there will be a clear depth of sixty feet; the piles which have been necessary to construct this dam were all in one length, from seventy-five to eighty feet long, and fifteen inches square—while of these piles nearly two thousand have been required, and some extraordinary fine specimens of oak measured one hundred and ten feet. This will afford some idea of the stupendousness of the undertaking. The oak came from the forests of Slavonia, in barges drawn by horses, and the fir timber from the forests of Bavaria and Upper Austria, down the Danube, a distance of some five hundred English miles. The total length of the bridge, with approaches, will be about six hundred yards—and will produce, from its peculiar situation in the centre of our capital, and amidst some of the finest buildings in Europe, a most imposing effect. This will be the first permanent bridge with stone piers built between Ratisbonne and the Black Sea, since the time of Trajan, A. D. 103, when a bridge was built across the Danube, at the Eixen Thor, or

Iron Gate, situated on the confines of Hungary and Servia, and where travelers perform quarantine before entering the Austrian dominions; the foundations of this bridge are still in existence, and are pointed out to the traveler, as well as the remains of a road hewn out of the solid rock, and which, constructed in part of timber, overhangs the river.

Lond. Min. Journ.

FRANKLIN INSTITUTE.

Fourteenth Exhibition of American Manufactures, held in the city of Philadelphia, from the 14th to the 30th of October, 1844, by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts.

The interesting ceremonial of distributing, '*to the most deserving*,' the awards made by the Committee on Exhibitions, was celebrated in the lecture room of the Museum, connected with the exhibition saloons, on the 24th of October, in the presence of a numerous audience, Thomas Fletcher, one of the Vice Presidents, presiding. Ellwood Morris, a member of the Committee, read the report, and, prior to this, John Wiegand, the chairman, delivered the following address:—

ADDRESS OF JOHN WIEGAND,

Chairman of the Committee on Exhibitions.

LADIES AND GENTLEMEN:—We meet you this afternoon to mingle again our congratulations over the achievements of American industry, taste, and skill. And here, on this occasion, we may meet, divested of every thing that partakes of party, or sectional, feelings, and, as citizens of this great republic, bear our grateful acknowledgments to the rapid and successful advance which the sciences and arts have made among us.

It is but little more than two centuries since the first colony of the pilgrim fathers sought a refuge and a home on the shores of America. They did not come to possess a land flowing with "milk and honey," in which the light of religion was shedding her benignant rays, and the arts and sciences, which bless and civilize man, were exerting their happy influence. They found this continent in all the original grandeur, yet sternness, of nature. It was exclusively the domain of the red man. Of the sciences and the arts he was utterly ignorant. To be successful in war and in the chase, was his highest ambition.

But how changed is the scene! The red man has passed away, and he lives now only in the tales of horror left us by the early settlers, or in the deep recesses of our western wilds. His hunting grounds are converted into fruitful fields, and where he made his council fires we have builded cities. The placid streams and lakes on which he launched his frail canoe are lashed into foam by the resistless steamship.

Our fathers who sought an asylum in the wilds of America, though blessed with unusual intelligence, were too fully occupied with clearing lands, and protecting themselves from savage beasts, and still more savage man, to find time to cultivate, to any extent, the useful arts. All that they could do was by the most rude contrivances to supply their most pressing wants. Necessity alone dictated the fashions of those days.

After a successful struggle to obtain a settlement, the mother country, as she was most strangely, but still fondly called, by various enactments prevented the growth of manufactures among the colonists. This was one among the many other grievances of which the colonists complained; and doubtless had its influence in accelerating the war of the revolution.

After the successful termination of our struggle for independence, and the adoption of the constitution, one of the first cares of the first Congress was for the manufacturing interests of the country.

And, notwithstanding the war of words, and the still worse war of feeling at the present day, the fathers of the constitution, and those who immediately succeeded them in carrying it into practical effect, looked for the perfection of our independence to the ability of the people to supply their own wants.

Our manufactures, however, did not keep pace with the other great interests of the country, commerce and agriculture; and the reason is obvious—Europe was in arms, her soldiery wanted bread, and we were found ready with supplies. Our merchants did a profitable carrying trade, and what of manufactures we needed we could pay liberally for.

It was not until the last war with England, that the country felt the importance of encouraging domestic manufactures. It was found at that period that we were literally destitute of the means of supplying our most necessary wants. It was, therefore, stern necessity which forced us into manufacturing.

Our first efforts were rude, and the fabrics which we then produced, and which were eagerly sought after, could not find, at this day, a market. The war with England was of short duration, and after its termination, and with the general peace of Europe, our country was inundated with foreign fabrics. They were sent here at prices so low as to involve in general ruin our own inexperienced manufacturers. The fact, however, was settled, that with proper encouragement, we had the industry and skill to supply our every want.

We date the establishment of manufactures as a great national interest within the last twenty years. By the wise and salutary measures adopted by Congress, manufactures were encouraged and protected; and they now form, and ever must form, one of the great leading interests in our national legislation.

Since this direct encouragement, extended by Congress, there is invested in capital the enormous sum of three hundred millions of dollars, for the production of all those articles that enter into the necessities, the comforts and elegancies of life.

All that can render man comfortable, and please the most fastidious

taste, can now be supplied by the skill of our own artizans, and at prices too which a few years since foreign manufacturers would have disdained to look at.

Many of the productions of our looms are now competing with European fabrics of the same description in foreign markets.

Our locomotives are to be found traversing the iron roads of Europe; and machines of pure American invention and construction, are astonishing the old world with their amazing powers; and entire establishments, with their proprietors, are transported to northern Europe, to construct machinery for Kings and Emperors.

But of our ability to manufacture—the specimens of skill, ingenuity, and taste, spread out before you in the present exhibition, in such rich variety and profusion, is one of the best and most convincing evidences that can be desired.

To form some just estimate of the extent of our manufactures, I have selected from the census of 1840, and from Professor Tucker's work on the "Progress of the United States in Population and Wealth," a few branches of the most important articles.

The value of Woolen goods is estimated, for the year 1840, to amount to

	\$20,697,699
Of Cotton goods to	46,350,453
Of Straw goods to	1,476,505
Of Wrought-Iron to	15,778,640
Of Cast-Iron to	7,172,275
Of Hardware Cutlery to	6,451,967
Of Machinery to	10,980,581
Of Hats and Caps to	8,704,342
Of Boots, Shoes, Saddlery, &c., to	33,134,403

Making the sum of \$150,746,465

To these should be added the various other products of the arts,—Glass, Cordage, Paper, Pottery, Books, &c., and the total of our manufactures will amount to two hundred and forty millions of dollars for the year 1840.

This sum, great as it is, will be doubtless greatly exceeded the present year, by the revival which has taken place in every branch of industry.

It may not be uninteresting here to say, that the New England and Middle States, containing less than two-fifths of the whole population of the union, produce more than three-fourths of all these manufactures.

The whole productive industry of our country, for the year 1840, was estimated as follows:—

Agriculture	\$ 654,387,597
Manufactures,	239,836,224
Commerce,	77,721,086
Mining,	42,358,761
Forest,	16,835,060
Fisheries.	11,996,008

\$1,043,134,736

It would be interesting here to trace the beneficial effects of the manufacturing and mining upon the agricultural interests, did time permit.

These wonderful and gratifying results at which we have so hastily glanced, have not been obtained without the aid of science; in every successful effort we may trace her hand. For the high attainments we have made we owe much to the skill of our artizans, but we owe more to the labors of science; without her aid and light, the best efforts of our artizans would have been but uncertain groping in the dark.

We desire to leave this truth indelibly fixed in the minds of our artizans, that to be successful in their callings they must be intelligent. We do not ask them to become teachers of science, but we do ask them to become intelligibly acquainted with the various processes in their respective arts.

The means of obtaining this information are so abundant, and so cheap, that no man, and especially no young artizan in the city of Philadelphia, can have any excuse for being ignorant. We are not now begging favors, or patronage, for the Franklin Institute, but it is pertinent to our purpose to say, that in the Journal of the Institute, in her library, and her lecture rooms, may be obtained almost gratuitously, all the information which they need.

In contemplating the extent to which the manufacturing interest of this country must reach, and the amount of population to which it will give employment,—we are led naturally to inquire what will be the character of this population, and its influence upon the institutions of our country.

We hold the opinion that legislative action ought to fix the minimum age of children who may be placed at factory labor, and the maximum number of hours they may daily be employed. We think it would be well to prohibit, by severe penalties, the employment of any child who had not received the rudiments of an English education. Much as we appreciate the importance of our manufactures, we appreciate the education of the laboring classes still more. Indeed the permanence and prosperity of our manufactures, we believe to be intimately connected with intelligent labor. We never can consent to see our system of manufactures made the means of rearing up among us masses of ignorance, which must finally sink into poverty, crime, and helplessness.

We have the means of preventing these evils which we deprecate, for in all the manufacturing States abundant provision is made for the education of every child.

In looking at the extent of our country, its diversity of climate and soil—the boundless resources of our forests, the wealth of our mines, and our growing population—our national prospects are grand beyond all precedent; and they will be realized, too, if we are only true to ourselves and our institutions; if our youth—the hope of the nation—are trained up in intelligence, and in habits of industry; and if, above all, they are taught their obligations to God and their fellow men. Without virtue and intelligence, prosperity will destroy us.

REPORT OF THE COMMITTEE ON EXHIBITIONS.

The Committee on Exhibitions of the Franklin Institute, respectfully Report:—

That in the fourteenth exhibition now being held, they find cause to note, in the products of American art, a progressive improvement which reflects credit, both upon the mechanics and manufacturers, and on our common country.

In examining the multifarious objects of ornament and use which have been deposited for public view, the conclusion that American industry is amply capable of supplying all our country's wants, has forced itself upon the minds of this committee.

Specimens of most of the articles of prime necessity to the human race in civilized life, are now developed in these museum halls, and evidently display a superiority of finish in their various details, which, to the observant eye, marks the fact, that the experience of another year has produced its appropriate effect upon our artizans.

The present year is one of great prosperity, the workshops of the country are in full operation, and the committee find occasion to congratulate themselves, that though the number of articles exhibited may not be greater than on some former occasions, still both manufacturers and mechanics have spared the time necessary to send hither for exhibition, suitable specimens of their skill and industry.

That the public are neither backward, nor superficial, in their scrutiny, nor apathetic to the exertions of their industrious countrymen, is proven by the crowds which have constantly filled our halls, and the deep interest displayed by them in their examination of the various articles.

The propriety of holding, at intervals, these displays of American art and science, receives in the present exhibition, for the fourteenth time, so strong an evidence of public favor, as prompts this committee to renewed energy for the collection and display of articles of utility, and will unquestionably encourage our manufacturers and mechanics to augment their exertions in the creation and finish of such articles.

We are much pleased to see in the present exhibition several very creditable articles, the manufacture of which is but of recent origin here, but which nevertheless promise speedily to equal the make of any country.

The institution for which we are now acting, has for its leading object, the promotion of the mechanic arts, and to further its design, many of our worthiest citizens have devoted, and will continue to devote, large portions of their time and talents, without any other reward than the advantage which they, in common with all, derive from the cultivation of science and the arts within our country.

The present exhibition is governed by the usual regulations, which have been made as public as possible. This committee have closely adhered to them, and they now return their warmest thanks to the joint and several committees of arrangement, for the skill, taste, and judgment displayed by them in adorning the saloons, by an appropriate display of the articles under their control.

We will now proceed to detail, from the reports of the Judges, a summary of those articles exhibited, which appear the most worthy of minute notice, and to this we shall append the awards of premiums which have been made.

The committee most sensibly feel this to be a very delicate and yet quite important branch of the duties devolved upon them.

Aided by the judgment of competent and disinterested men, they have made their awards without fear, favor, or affection, and yet they are conscious that, in a grand array of several thousand articles, there may possibly be some which have been overlooked, though well deserving notices, or even premiums.

Relative to any such, however, we can only express the regret which every exhibition brings up to our minds, that the limited time for examination, and the immense number of articles to be examined, almost necessarily preclude our noticing, as we would wish, many truly meritorious objects, which both the judges and ourselves may have accidentally omitted to examine.

In conclusion we feel bound to add a remark upon a growing practice, which we find it impossible to view with approbation.

A number of our manufactures have attained such a degree of perfection, as to be equal, or superior, to the best of imported articles, and have enabled their makers to place upon them the foreign marks, and advantageously to enter them for sale in the general market, as the products of the industry of other countries.

This practice is, to a certain extent, fraudulent. It is certainly discreditable to this country, and it is with great regret that we think we perceive an increase of it during the present year.

I.—Cotton Goods.

As has been usual in our exhibitions, the display of cotton goods, and especially of prints on cotton fabrics, is very fine.

When reporting last year upon cotton prints, we supposed the beautiful specimens then exhibited could scarcely be surpassed, but after a minute examination, we find that those of the present year have attained even a higher pitch of perfection, and fully justify the admiration bestowed upon them by the public.

Based upon the report of the judges of this department, we make the following awards:—

No. 35 and 36, cambric and furniture dimity, manufactured by Benjamin Marshall, Oneida county, New York, deposited by John W. Downing, well made and finished, so as to be scarcely inferior to imported fabrics of this kind. A Silver Medal.

No. 156, printed cotton and woolen balzorines, by Isaac P. Wendell & Co., of Philadelphia county, deposited by David S. Brown & Co.; for the printing of these upon foreign fabrics, in a beautiful and tasty manner, we award A Silver Medal.

No. 37, twilled Silesias, by Benjamin Marshall, Oneida county, New York, deposited by John W. Downing, of fine texture, but admitting of better finish. A Certificate of Honorable Mention.

No. 6, cotton duck for sails, made by Gambrill, Carrol & Co., Bal-

timore, deposited by James Maull, jr., a good, substantial article.

A Certificate of Honorable Mention.

No. 140, shoe thread, both bleached and colored, manufactured by Gould & Whetham, Manayunk, Pennsylvania, from American flax; possesses all the necessary requisites of shoe thread, and is an excellent article.

A Certificate of Honorable Mention.

The judges also speak favorably of the sail twine and carpet chain of these manufacturers.

No. 153, Marseilles, for toilet covers, &c., made by R. Garsed & Brothers, of Philadelphia county, deposited by Tingley, Caldwell & English, not heretofore made in quantity, is a very creditable article, but might be improved in the finish with advantage.

A Certificate of Honorable Mention.

No. 199, fine cotton yarn, Nos. 40, 70, and 100, manufactured by the James' Steam Mill, at Newburyport, Mass., deposited by Charles W. Churchman; is beautifully even, and well made. The yarn No. 100, is believed to be the first of that fineness yet spun here in quantity, though small amounts have heretofore been made upon the Brandywine; we hail it as the precursor of the manufacture of fine fabrics of cotton, and award to it

A Silver Medal.

The judges very justly speak, in the highest terms, of the beautiful array of cotton prints.

The specimens from Andrew Robeson & Sons, Fall River, Mass.; B. Cozzens, Providence, R. I.; I. P. Wendell & Co., Philadelphia; American Print Works, Fall River, Mass.; J. Dunnell & Co., Providence, R. I., and the Woonasquatucket Print Works, of Providence, R. I., are all rich, and glowing with brilliant colors, very tastefully arranged and blended.

The judges express diffidence in deciding between these elegant products of American art, but appear to think the prints of Andrew Robeson & Co., rather superior to the rest in accuracy of execution; they recommend, and we award, to *each* of these six concerns

Certificates of Honorable Mention.

Cotton prints from the Merrimack Company, Lowell, Mass., and from Joseph Ripka, of Manayunk, Penna., fully sustain the reputation of these well known manufacturers.

Printed lawn, by B. Cozzens, Providence, Rhode Island, was much admired.

Shirtings made by Marshall, New York Mills, and the James' Steam Mill, Newburyport, Mass., are excellent articles, particularly those from the latter factory.

Handsome specimens of mousseline de laine and balzorine prints, from J. Dunnell & Co., Providence, Rhode Island, deserve notice, but came too late for competition under our rules.

Some very creditable shirtings, casbans, and paper muslins, from the Lonsdale Manufacturing Company, Newburyport, Mass., arrived too late for competition.

There are exhibited shirtings, from the Merrimack, Hamilton, Phoenix, Waltham, Great Falls, Bartlett, Boot, and Carlisle Factories.

Sewing cotton, by Freeman Winn; printed cloak linings, boot laces

and braids, by Fletcher & Bros.; knitting cotton, by Haworth; ticking, by Robert Whitaker; cotton fringe, by Christian Linck; check, by C. McCuen; cotton flannel, counterpanes, suspenders, bath cords, cotton cords, nankeens, &c., all of them, especially the coarse cotton fabrics, are very good of their kind, but do not possess sufficient superiority over similar articles formerly exhibited, to require the bestowal of premiums.

In concluding their report, the judges seem to incline to the opinion that cotton goods of novel styles, known to be in our market, have been withheld from the present exhibition through "*inattention, indifference, or a desire of secrecy.*" If this is really so, we most sincerely regret it, on account of the manufacturers themselves, since experience has certainly most amply shown that the public display of meritorious articles is very decidedly advantageous to the makers of them. At a late period of the exhibition, some very beautifully finished, soft, even, and well printed mousseline de laines, were forwarded by the Woonasquattuck Print Works, Providence, R. Island, which are highly creditable specimens of a manufacture but recently introduced into this country.

II.—Woolen Goods.

We are glad to notice in this branch of our exhibition, a continuance of that progressive improvement which has gradually raised the woolen manufacture of America to a position of vast importance and utility. The judges notice in this department a large number of meritorious objects, and, conformably to their report, we make the following award of premiums:—

Nos. 60 and 61, five quarter cloakings, from Gilbert & Stevens, of Ware, Mass., deposited by Stone, Slade & Farnham, of admirable style and finish.

A Silver Medal.

No. 70, embroidered woolen shawls, from Duncan & Cunningham, of Belleville, N. Jersey, deposited by David S. Brown & Co.; reflecting great credit on the maker, particularly in the embroidery.

A Silver Medal.

Nos. 73, 74, 191, 192, and 193, nine pieces of six quarter plaid, or Highland cassimere, made by W. & D. D. Farnum, of Waterford, Massachusetts, deposited by David S. Brown & Co. Although similar in style to the three-quarter goods of the same make, yet, in consequence of their width and superior quality, we award them

A Silver Medal.

Nos. 89 and 90, blankets, from the Gonic Manufacturing Company, Rochester, Mass., made of fine Pennsylvania wool, forming a very superior article of its class, and deposited by David S. Brown & Co.

A Silver Medal.

Nos. 194, 195, 196, 197, and 198, superfine black cloths, made by W. & D. D. Farnum, of Waterford, Mass., and deposited by David S. Brown & Co.; these cloths receive a warm commendation from the judges, to which their superior make and finish very justly entitle them.

A Silver Medal.

No. 81, black satinets, similar to the above, made by the Leeds Manufacturing Company, of Rockville, Conn., deposited by Dulles, Aertsen & Fisher.

A Certificate of Honorable Mention.

Nos. 62 and 63, white flannels, from Gilbert & Stevens, of Ware, Mass., deposited by Stone, Slade & Farnham, are very excellent goods, and we award them A Certificate of Honorable Mention.

Nos. 71 and 72, embossed table covers, from Duncan & Cunningham, of Belleville, N. J., deposited by David S. Brown & Co.; these reflect much credit on the makers.

A Certificate of Honorable Mention.

No. 76, a good specimen of black cloth, from W. & D. D. Farnum, of Waterford, Mass., deposited by D. S. Brown & Co

A Certificate of Honorable Mention.

Nos. 77 and 78, plaid cassimeres, from W. & D. D. Farnum, Waterford, Mass., deposited by D. S. Brown & Co., are goods of excellent quality, and deserve A Certificate of Honorable Mention.

No. 80, black satinets, from W. B. Hotchkiss & Co., of Waterbury, Mass., deposited by Dulles, Aertsen & Fisher, made of fine wool, very skilfully wrought, and forming a meritorious fabric.

A Certificate of Honorable Mention.

No. 82, a lot of hosiery, from John Hopkins, of Philadelphia, deposited by the maker, contains some beautiful articles, and deserves

A Certificate of Honorable Mention.

Nos. 106 to 117, black and blue cloths, from the North Field Manufacturing Company, of Northfield, Vermont, deposited by David S. Brown & Co.; these are well finished, and substantial goods.

A Certificate of Honorable Mention.

Nos. 178 to 181, Saxony cloths, from S. Slater & Sons, of Newburyport, Mass., deposited by W. R. Hanson & Brother, are regarded as very excellent in quality, and deserving

A Certificate of Honorable Mention.

Nos. 182 to 185, black cloths, from the Hamilton Woolen Mills, of Southbridge, Mass., deposited by W. R. Hanson & Brother, appear to be substantial fabrics of good finish, and deserving

A Certificate of Honorable Mention.

Nos. 186 to 190, fancy plaid cassimeres, from W. & D. D. Farnum, of Waterford, Mass., deposited by D. S. Brown & Co., are deemed to be of superior make and finish.

A Certificate of Honorable Mention.

No. 203, ten pieces of figured cassimere, made by Edward Harris, of Woonsocket, R. Island, deposited by David S. Brown & Co.

A Certificate of Honorable Mention.

No. 21, a lot of exceedingly beautiful woolen and worsted yarn, made by Moses Hey, of Springfield, Delaware county, Penna., some of it spun remarkably fine, and all very even, and excellent in quality, we award

A Certificate of Honorable Mention.

The judges have noticed in terms of approbation the following:—

No. 29, double milled black satinets, from the Bristol Manufacturing Company, Conn., deposited by Holmes & Hubbard.

No. 32, three quarter tweeds, from Edward Denny, Worcester, Mass., deposited by Brown, Earle & Erringer.

No. 64, a lot of wool in the fleece, from the prairies of Illinois, deposited by James Mott & Co.

No. 66, fleece wool, from West Alexandria, Penna., deposited by Houston & Robinson.

Fleece wool, from Columbia county, Penna., deposited by James Mott & Co.

No. 75, three quarter, and six quarter fancy cassimere, from W. & D. D. Farnum, Waterford, Mass., deposited by D. S. Brown & Co.

No. 138, two blankets, from Hutchcraft, of Paris, Kentucky, deposited by T. C. Rockhill & Co.

No. 204, an invoice of shawls, from James Nelson, of Philadelphia, deposited by the maker.

In concluding our notice of the woolen goods, we should not do full justice to the manufacturers of the fabrics exhibited, if we omitted to express the high satisfaction with which we examined many of the specimens of this important branch of art, which we conceive to be at this time making rapid progress towards a point of perfection that will equal, or surpass, even the most sanguine expectations of those who have observed the peculiar difficulties under which it has labored onwards.

III.—*Carpets and Oil Cloths.*

This department, so fully and beautifully represented last year, is, we regret to say, a very meagre one on this occasion. There are several very creditable articles, but none display the superior merit we have been accustomed to hail in this branch of manufactures.

We allot the following premiums:—

No. 25, two ply ingrain carpets, from Andrew Alcorn, of Philadelphia, a very fair article, and particularly well woven.

A Certificate of Honorable Mention.

No. 149, a piece of list carpeting, from John Lancaster, of Philadelphia.

A Certificate of Honorable Mention.

No. 1, oil cloth, from C. M. Bailey & Co., Winthrop, Maine, deposited by J. M. Ellis, esteemed by the judges to be a very superior article.

A Certificate of Honorable Mention.

No. 2, an oil cloth, from A. Johnson, Cincinnati, deposited by J. M. Ellis, appears to be a very good and serviceable article.

We are not aware of the cause of the deficient exhibition of carpets and oil cloths, but we hope it has arisen from the numerous engagements of the manufacturers of these articles. The oil cloths exhibited from Macaully's celebrated establishment, are very beautiful, and we award them

A Certificate of Honorable Mention.

IV.—*Silk Goods.*

The fabrics of Silk, now exhibited, show that this manufacture is advancing with a firm and steady progress, which, in due time, will bring it into line with other similar branches of art, which have been longer established, and more generally attended to by our people.

The committee consider the productions of the current year to be such as afford ample encouragement for further exertions, and they make the following awards:—

No. 8, one case of silk goods, including one piece of plaid silk vel-

vet, from J. W. Gill, of Mount Pleasant, Jefferson county, Ohio; the first yet exhibited. A Silver Medal.

No. 41, ladies' silk clothing, a complete suit, including a bonnet, from silk grown in Pennsylvania, and manufactured by Mrs. McLanahan, of Philadelphia, who reeled every thread at her filature.

A Certificate of Honorable Mention.

No. 70, silk embroidered shawls, from Duncan & Cunningham, of Belleville, N. J., deposited by David S. Brown & Co., for the silken embroidery,

A Certificate of Honorable Mention.

No. 139, satin stocks, made of American silk, by Mrs. Kneeland, of Philadelphia.

A Certificate of Honorable Mention.

No. 145, embossing on French ribbon, said to be the first attempt in this country, by C. S. Marshall, of Philadelphia.

A Certificate of Honorable Mention.

The judges speak very favorably of the following:—

No. 40, three pounds of assorted sewing silk, from the New England Silk Company, of Dedham, Mass., deposited by E. M. Davis.

No. 68, one case of sewing and floss silk, from W. H. Richards, jr.

No. 3508, stocks exhibited by C. A. Walborn, of Philadelphia.

No. 1014, stocks exhibited by H. V. Wright, of Philadelphia.

221, one box of colored galloons, from W. H. Richards, jr.

No. 223, two very beautiful silk shirts, from T. R. Fisher, of Philadelphia, deposited by Hall & Brothers, arrived too late for a premium to be awarded.

No. 1600, black kid gloves, deposited in this department by William Hawkins, of Philadelphia, and No. 1603, similar articles, by J. R. Ashford, of Philadelphia, are particularly referred to by the judges as being of very superior quality, and we award to each

A Certificate of Honorable Mention.

In conclusion, we may express the gratification we feel at the intelligence that the silk manufacture is rapidly extending itself in the western quarter of the United States, and drawing towards it a considerable amount of capital, and labor, promises to be sufficiently remunerative to justify a considerable extension of its field of action.

V.—Iron and Steel.

Through the activity of the firm of Morris & Jones, of Philadelphia, and other houses, in bringing forward for exhibition specimens of the Iron and Steel consigned to them, the display in this most important department is highly creditable to the great iron interest of the country: the judges have given their usual minute and careful attention to the various samples, and agreeably to their reported opinion, we take pleasure in making the following awards:—

No. 2705, a bar of edge railroad iron, of the U form, rolled by the Mount Savage Iron Works, near Frostburg, Md., and forwarded by Col. Young, the manager. This bar, 18½ feet long, weighs 40 pounds to the yard lineal; it is part of a lot of several hundred tons recently rolled there for a branch of the Baltimore and Ohio Railroad, leading to the works. This bar is amongst the first edge rail yet rolled in the United States, and it demonstrates, beyond the reach of cavil, that

edge railroad iron can be well manufactured in America. This bar is well proportioned, sound, and well finished; it is the first ever exhibited here of American make; we hail it with pleasure as the beginning of a new manufacture, and award to it

A Silver Medal.

No. 2639, hammered bar-iron, from Castle Fin Forge, deposited by Morris & Jones; the bars are exceedingly well hammered, and the iron is of superior quality. A Certificate of Honorable Mention.

No. 2640, hammered iron from Speedwell Forge, deposited by Morris & Jones; the same remarks apply as to No. 2639.

A Certificate of Honorable Mention.

No. 2668, rolled iron from Colemansville Works, deposited by Morris & Jones; this sample is of a very superior quality.

A Certificate of Honorable Mention.

The judges notice in terms of approbation No. 2638, hammered iron, from Spring Forge, deposited by Morris & Jones. Rolled and slit rods, from Colemansville Iron Works, and others from Howard Iron Works, deposited by the same, and all of good quality. No. 2554, rolled and slit rods, from the Juniata Iron Works, deposited by Isaac Miller. No. 2523, two large sheets of boiler iron, made by Rowland & Hunt, are very well rolled, and weigh 216 and 305 lbs. No. 2667, four very large sheets of boiler iron, by Forsyth & Sons, deposited, like the preceding, by Morris & Jones, measure 15 feet long by 26 inches wide, and weigh about 340 lbs.; they have a very good appearance. No. 2535, two very large sheets of boiler iron, 14 by 2½ feet, made by J. & J. Parke, and deposited by Orrick & Campbell. Also one sheet, 15 feet by 26 inches, by Steele, Work & Edge, deposited by the same. All these three sheets appear very good, and are fine specimens of rolling. No. 2639, blistered steel, by W. C. Shay, deposited by Morris & Jones, and made from American iron, is a good steel. No. 2535, blistered steel, made and deposited by John Robbins; it is a fair article. No. 2587, imitation of Russia sheet-iron, by A. Wood & Brother, maintains, and even improves, its already high reputation. No. 2601, several sheets of this iron tinned by H. W. Butterworth, are very handsomely tinned, but are not now quite equal to English tin plate, though they bid fair soon to rival it. We award to him

A Certificate of Honorable Mention.

A quantity of gas tubes and fittings, by Morris, Tasker & Morris, maintain the reputation of these well known makers. Similar articles by S. & W. Griffiths, also appear very perfect.

VI.—*Umbrellas, &c.*

This manufacture displays its usual degree of neatness and utility. The judges recommend, and we award to

No. 2052, a lot of umbrella, parasol, and shade stretchers, manufactured by Messrs. Barnhurst & Son, of Philadelphia, all excellent articles, which, until very recently, have wholly been imported, and the entire lot evincing most excellent workmanship.

A Silver Medal.

No. 143, a lot of umbrellas, by W. A. Drown, Philadelphia. No. 200, umbrellas and parasols, by W. & W. H. Richardson, Philadel-

phia, are deservedly praised by the judges, being, in fact, very good articles of their class, and we award to each

A Certificate of Honorable Mention.

VII.—*Lamps and Gas Fixtures.*

As has been usual of late years, the display in articles of this branch is truly magnificent in the present exhibition. The high degree of skill already attained by our workmen in these fabrications of metal forbids the expectation of much further advance in point of beauty of execution, but the details of arrangement may be improved, the economy of construction further sought, and a slightly higher degree of finish produced. In these respects the judges have found cause to note a degree of progress justifying the following awards:—

No. 2071, &c., lot of gas pendants, chandeliers, candelabra, solar, and other table lamps, by Cornelius & Co., of Philadelphia, the finish of which, and especially the beautiful galvanotype silvering of the white work, is of superior excellence. A Silver Medal.

No. 570, gas chandelier, of very tasteful design, by E. Whelan, of Philadelphia, but admitting of higher finish.

A Certificate of Honorable Mention.

No. 2116, a creditable display of very well made solar lamps, by E. S. Archer, of Philadelphia. A Certif. of Honorable Mention.

No. 1047, a large assortment of hand, and students' lamp lamps, by J. W. Henry, of Philadelphia. A Certif. of Honorable Mention.

No. 2051, a neat chandelier, and two bracket lamps, for pine oil, by M. B. Dyott, of Philadelphia. A Certif. of Honorable Mention.

W. Munsig exhibits a very neat and well made gas chandelier, which attracted the attention, and received the admiration of the judges, but came too late for competition.

As having relation to this department, the committee will mention, that the Bude and the Boccus gas lights, which they were enabled to employ by night in the upper saloon, through the liberality of the Trustees of the Philadelphia Gas Works, were very brilliant, and much admired. The Bude light, in particular, developed a very intense and beautiful light, which illuminated with striking distinctness every object within its sphere of action.

VIII.—*Hardware and Cutlery.*

The articles in this department are very numerous. Many of them possess unusual excellence and beauty, and the whole have been subjected by the judges to a minute examination, which has resulted in recommending the following awards, which are confirmed by the committee:—

No. 1004, a card of assorted files, made by Robert Murphy, of Philadelphia, nearly equal in quality to the imported "Stubbs'" Lancashire files, and much cheaper. A Silver Medal.

No. 1020, one case of guns, rifles, and muskets, by John Krider, of Philadelphia, displaying great taste, elegant workmanship, ample strength, and deemed to be the best ever exhibited.

A Silver Medal.

No. 1023, one card and four packs of pins, made by Slocum, Tillson & Co., of Waterbury, Conn., deposited by F. V. Krug & Co.; this is comparatively a novel manufacture in this country, and these articles have the heads smooth, the shanks well proportioned, smooth, and elastic. A Silver Medal.

No. 1039, a lot of sad irons and hollow ware, made by Savery & Co., of Philadelphia, truly admirable specimens of the founder's art, and surpassing any before exhibited. A Silver Medal.

No. 1061, one case of tailor's shears and hair scissors, made by R. Heinesch, of Newark, N. J., and deposited by J. H. Harkness, of Philadelphia, considered to be very elegant specimens of this branch of art. A Silver Medal.

No. 1061, one case of locks, made by Augustus Prutzman, of Philadelphia, the safety lock in particular evincing the highest ingenuity. A Silver Medal.

No. 1070, one card of butt hinges, made by the New England Butt Hinge Company, of Providence, R. I., deposited by E. J. Feinour; an article of much importance, and exceedingly well made. A Silver Medal.

No. 1083, one case of fine table cutlery, made by J. Russell & Co., of Greenfield, Mass., deposited by Curtis & Hand, displaying great taste, good temper, and high finish. A Silver Medal.

No. 1091, a patent safety lock, made by Thomas P. Murphy, of Philadelphia, particularly designed for banks, and other strong holds, the workmanship being unexceptionable, and the whole contrivance very ingenious. A Silver Medal.

No. 1006, several patent coffee mills, by John Rittenhouse, of Germantown, Penna., very well and beautifully made. A Certificate of Honorable Mention.

No. 1007, a card of rasps and files, made by George Machen, of Philadelphia, well cut, and well proportioned. A Certificate of Honorable Mention.

No. 1009, four pieces of britannia ware, made by Joseph G. Morrow, of Philadelphia, an article of excellent make and color. A Certificate of Honorable Mention.

No. 1015, one of Jenk's patent carbines, (very creditably made by N. P. Ames, of Chicopee, Mass.,) loading at the breech in a peculiar manner. This arm has been very severely but very successfully tested in our army, by order of the Secretary of War, and bids fair to supercede other carbines. We award to it, for the manufacture, a Silver Medal, and, for the invention, the Committee on Science and the Arts has already awarded a premium.

No. 1028, two cards of door locks, latches, and door springs, by T. L. Littlefield, of Philadelphia, very creditable both in design and execution. A Certificate of Honorable Mention.

No. 1029, one lot of hay and manure forks, made by John F. Hopkins, West Cambridge, Mass., deposited by David O. Prouty; very well tempered and finished. A Certificate of Honorable Mention.

No. 1032, a case of butchers' knives, &c., made by Henry Huber,

jr., of Philadelphia, showing decided improvement, good proportion, and finish. A Certificate of Honorable Mention.

No. 1035, one case of awl blades, made by Thorp & Hall, of Philadelphia, a new article of American make, and of good quality.

A Certificate of Honorable Mention.

No. 1037, a bench vice, made by C. C. Chapman, of Philadelphia, a well finished article, adapted to holding both parallel and wedged shaped pieces.

A Certificate of Honorable Mention.

No. 1044, a case of Britannia ware, made by Hall, Boardman & Co., of Philadelphia, which are very creditable specimens of material and work.

A Certificate of Honorable Mention.

No. 1077, a lot of carpenters' planes, made by John Colton, of Philadelphia, the neatest and best finished exhibited.

A Certificate of Honorable Mention.

No. 1087, a card of pins, assorted, made by Mitchell & Wetherill, of New York, deposited by Curtis & Hand, very good specimens of manufacture.

A Certificate of Honorable Mention.

No. 1090, a case of trunk locks, made by Goodwin & Carr, Tenysville, Conn., deposited by Thompson & Carr, a comparatively new article of manufacture here, and strong, neat, and well finished.

A Certificate of Honorable Mention.

No. 1100, one stand of sample stair rods, made by Edward Jones, of Philadelphia, displaying good taste, and high finish.

A Certificate of Honorable Mention.

No. 2562, a case of shuttles, made by E. D. Tripp, of Trenton, N. J., deposited by A. W. Tiffany, are well made, and unusually well finished.

A Certificate of Honorable Mention.

The judges also notice minutely, and with many expressions of approbation, the following articles, viz:—

No. 1008, silver mounted hunting sword, made by Jacob Faser, of Philadelphia; No. 1012, three cast-iron planes, made by the Savage Manufacturing Company, Md.; No. 1014, samples of gravitating locks, by S. C. Bemis, Springfield, Mass.; No. 1017, one case of rules, by Bremner & Co., N. Y.; No. 1018, one case of sample wrenches, by Merrick, of Springfield, Mass.; No. 1021, scythes, by Mansfield & Holman, Smithfield, R. I.; No. 1022, a case of rules, by Herman Chapin, New Hartford, Conn.; No. 1024, planes, by E. W. Carpenter, of Lancaster, Penn.; No. 1027, three scythes, by Hale, Waters & Co., Millbury, Mass.; No. 1038, cotton and woolen cards, by Prentiss & Brother, of Philadelphia; No. 1040, lever suspender buckles, by James Bingham, of Philadelphia; No. 1062, shovels, spade, and saw, by A. Wood & Co., of Philadelphia; No. 1064, lock castings, made by Cyrus Mansfield, of Elizabethtown, N. J.; No. 1069, files, by Thomas Perrins, of Philadelphia; No. 1071, rivets of iron, assorted, made by Faris, Edes & Co., of Plymouth, Mass.; No. 1073, locks, by Lewis McKee & Co., Tenysville, Conn.; No. 1075, spring cutlery, made by Bradley & Beecher, Naugatuck, Conn., to which last we award

A Certificate of Honorable Mention.

No. 1080, hooks and eyes, by S. J. North, New Britain, Conn.; No. 1084, wood screws, by the New England Company; No. 1086, plane

irons, made by William Field, of Pawtucket, R. I.; No. 1088, bolts, made by Mattison, Russell & Co., New Britain, Conn.; No. 1094, circular saws, by Hoe & Co., of New York; No. 1096, repeating rifle, by H. Gross, Tipton, Ohio; No. 2007, hooks and eyes, by S. J. North, of New Britain, Conn.; No. 2043, shovels and spades, by T. C. Wood, of Philadelphia; No. 2501, rakes of wood and iron, by Henry Porter, Northumberland county, Penn.; No. 2551, shovels, by J. Richards, jr., of Philadelphia; No. 2570, screens, riddles, &c., by J. & D. Sellers, of Philadelphia; No. 2619, scales, by G. R. Moore, of Philadelphia; No. 1101, a carriers' knife, by Stephen Parry, of Philadelphia, for which last we award A Certificate of Honorable Mention.

The judges further notice favorably:—

No. 1098, molasses gates and turn buttons, by G. Jordan, of Philadelphia; No. 1106, spring cutlery, (pocket and pen knives,) by Wm. Wild, of New York, to which we award a

A Certificate of Honorable Mention.

No. 2658, wire screens, by Thomas S. Speakman, of Philadelphia; and finally, No. 2560, samples of cast-iron butt hinges, by Morris, Tasker & Morris, but those in the bundles are manifestly inferior to the samples.

In conclusion, the committee feel free to say, that in no department of American manufacture have they noticed more decided improvement than in the Hardware and Cutlery.

IX.—*Saddlery, Harness, and Trunks.*

A number of very neat and creditable articles are exhibited in this department, but they do not appear to possess any very marked superiority over the products of preceding years.

We make here the following awards:—

No. 523, fly nets, knotted by a machine expressly invented for the purpose, by John McMullen, of Baltimore; these are very good articles, but are usually made by hand, and are now, we believe, for the first time, made by machinery, consequently, we award, for the ingenuity displayed,

A Silver Medal.

No. 559, a set of harness, made by Hughson & Vale, of Baltimore, Md., deposited by Mahlon Warne, which is very superior, and does great credit to the workman. A Certificate of Honorable Mention.

To John Unruh, of Philadelphia, for No. 531, a leather trunk, highly spoken of by the judges. A Certificate of Honorable Mention.

The judges speak in high terms of approval of No. 512, fly nets, by Miller & Mentz, of Philadelphia, deposited by the maker; No. 558, a very neat and well made gentleman's saddle, by William Hawkins, jr., of Baltimore, Md.; No. 560, a set of coach harness, by William N. Lacy, of Philadelphia; No. 559, a riding saddle, by Hughson & Vale, of Baltimore, Md.; a leather trunk, by James E. Brown, of Philadelphia; No. 546, two leather trunks, made by A. L. Hickey, of Philadelphia; No. 562, two very neat carpet bags, by Wm. R. Scott, of Philadelphia; No. 565, a valise trunk, neatly made, by Charles W. Conrad, of Philadelphia; and No. 582, a trunk of very creditable design and workmanship, by Isaac Hammit, of Philadelphia, deposited by Wm. R. Scott.

X.—*Models and Machinery.*

This very important department of manufacturing industry, which lies, in fact, at the foundation of the rest, since its province is to form the tools with which they work, is not so well and fully represented as the committee thought they had reason to expect. Last year the mechanics assigned the depressed condition of the trade as a reason for not bringing forward to the public view more specimens of their skill; but surely at the present moment, when the machine shops of the country are overflowing with work, that reason can no longer prevail. That the mechanic arts are keeping pace with other industrial branches, is a fact, which, in their business relations, the committee are quite aware of, and this knowledge adds to the regret we feel that our able artizans have not sent forward more numerous specimens of their skill. Still, amongst the articles exhibited, there are certainly some very meritorious machines, and, as the importance of this department seems to require it, we have embodied and adopted the report of the judges in greater detail than has been customary with us heretofore.

No. 2503, shearing machine, by Parsons and Wilder, of Hoosick Falls, New York, deposited by Thomas B. Slater, a well made machine, but not as simple and accessible as some others for the same purpose.

Nos. 2505, 2512, 2522, 2537, 2595, models of steam engines, by various makers, in which the proper proportions of the details seem to have been wholly disregarded, and, therefore, they are not worthy of special notice.

No. 2507, a piece of flat rope, which appears to be very well made.

No. 2508, model of a hose carriage and house, by Thomas Mason, of Philadelphia, very neatly made indeed.

No. 2511, model of a machine for splitting hoops; the committee are not sufficiently familiar with the contrivances in use for the same purpose, to judge of its novelty, but it seems to be ingeniously contrived, and will probably answer a very good purpose.

No. 2513, washing machine, made by E. Lukeus, of Baltimore, of very simple construction, and, report says, works well.

No. 2514, a milling machine, used in coining money, made by George Eckfelt, foreman of the United States Mint; this machine, planned by Mr. Peale, the chief coiner, is of the same elegant design as those already in the mint, and is deposited by the maker as a specimen of workmanship. The whole machine seems to be absolutely without a fault, and all the details are in the most admirable "keeping." The accuracy of the workmanship, and exceeding beauty of finish, cannot be surpassed. It merits the strongest terms of praise, and we take pleasure in awarding, for the beauty and accuracy of the workmanship in this and No. 2515, A Silver Medal.

No. 2515, assayers' rolls, by the same maker; the arrangement is good, and the workmanship of the same admirable character as that of the milling machine just mentioned.

No. 2516, a lathe, with spiral gearing; this is an excellent speci-

men of workmanship and finish, by Jonathan Tompkins, of the United States Mint—we award it A Certif. of Honorable Mention.

No. 2518, a beautiful finished working model, made by W. Lawrence, N. Y., complete in all the details, of a New York fire engine; this is one of the most beautiful models of the kind we have ever seen, and reflects much credit on the maker. It is deposited by the Humane Engine Company, and we award it A Silver Medal.

No. 2519, the Humane Hose Carriage, by John Agnew, of Philadelphia, displays great elegance and beauty of finish, combined with extreme lightness. It well deserves a premium, but Mr. Agnew being a member of the Board of Managers, cannot receive any.

No. 2531, platform scales, by Ellicott & Gibson, Philadelphia; neatly made and simple, but no novelty was observed.

No. 2534, hemp hose, made by Amasa Stone, of Philadelphia; this is an article that does not properly come in this department, but appears to be well and strongly made.

No. 2542, model of a telegraph; this has already been before the Committee on Science and the Arts, and, no doubt, has been properly noticed by that body.

No. 2548, fire proof chest; one of the same kind, by the same makers, Evans & Watson, of Philadelphia, was exhibited and noticed at the last exhibition. The only novelty which the makers have introduced in it is in the use of the tumbler, or slide, which is ingeniously contrived so as to cover the key-hole when the key is withdrawn, and which must be removed before the key can again be introduced. The committee think that this improved escutcheon adds to the security of the lock, and we award it

A Certificate of Honorable Mention.

No. 2549, platform scales, made by Fairbank; the specimens are similar to those formerly exhibited by the same maker. They are very neatly made and finished, and sustain their reputation fully.

No. 2550, model of a canal boat, by N. B. Jenner, of Philadelphia, intended, we believe, to illustrate a new method of propelling, invented by the maker. This contrivance has already been submitted to the Committee on Science and Art, and is not one to be recommended.

No. 2552, patent spring perch for carriages, made by E. I. Gilbert, of Bridgeport, Conn., and deposited by Samuel W. Jacobs, of Philadelphia; this contrivance is lighter and more graceful than the common perch, and facilitates the motion of the carriage upon the springs. This appears to be a meritorious method of construction, and deserves reference to the Committee on Science and the Arts; we award it

A Certificate of Honorable Mention.

No. 2553, a lot of agricultural implements, deposited by D. O. Prouty, of Philadelphia, all of which seem to be very well made. The judges were not familiar with these articles, and did not, therefore, notice them as fully as they would wish. The centre draught plough, made by D. Prouty & Co., of Boston, Mass., appears to have some advantages over others; we award to it

A Certificate of Honorable Mention.

The drill, too, appears to be well adapted for the purpose for which it was intended; in fine, all of these specimens seem to be well, neatly, and strongly made, and are, no doubt, efficient implements.

No. 2557, a shower bath, made by Bates, of Boston, deposited by A. McDonough, of Philadelphia, arranged with a sliding top, so that the reservoir can be drawn down to a convenient height to be filled. This arrangement would, no doubt, be very convenient in many cases; we award it

A Certificate of Honorable Mention.

No. 2560, a lot of iron tubes and flues, for steam boilers, made by Morris, Tasker & Morris; they are all well made and good articles, such as the makers have previously exhibited; we award then

A Certificate of Honorable Mention.

No. 2564, a fire engine, (*Hibernia*) made by John Agnew, of Philadelphia, in his usual neat, elegant, and efficient style, which is so familiar to this community, as not to require any lengthy notice from us.

No. 2567, shearing machine, by W. H. Howard & Son, of Philadelphia; this appears to be a machine of no ordinary merit. It is well and neatly made, and embodies some important improvements, by which the parts are made simple and easy of access, the adjustments more easily made, and the cloth more easily placed in the machine. By the substitution of a larger shearing roller, with an increased number of blades, it is thought that it will be the best machine of the kind in use. If the improvements which have been introduced are new and original with Mr. Howard, we think it would be proper for him to submit the machine to the Committee on Science and the Arts, for a more extended notice and examination. We take pleasure in awarding to the makers of this valuable machine

A Silver Medal.

No. 2584, a machine for cutting beef, made by John Wilson, of Philadelphia, which looks as if it would answer the purpose well.

No. 2593, a pair of smith's bellows, of superior workmanship and materials, made by R. H. Eckstein, of Philadelphia.

A Certificate of Honorable Mention.

No. 2496, a pair of slide rests, by J. H. Schrader, of Philadelphia; these are very well made, and have attached to them the maker's improvements for adjusting the rest with facility and accuracy for turning cones, or taper pieces. We take pleasure in awarding to the productions of this excellent mechanic

A Certificate of Honorable Mention.

No. 3608, a universal chuck for lathes, made by George Lyle, of Philadelphia; this is the best contrivance for the purpose that we have seen; it is well made, and we award it

A Certificate of Honorable Mention.

No. 2609, a patent revolving window shutter, or close blind, formed of wrought-iron plates, and made by Potts & Yocum, of Philadelphia; this is the first shutter of this description that we have seen, and we are scarcely competent to speak understandingly of its merits. Nevertheless, we have learned that it has been very advantageously used in the city of Boston, and is much approved by those who have em-

ployed it, as being both convenient and thief-proof. It has our approbation as a meritorious article. We would suggest to the makers to submit it to the Committee on Science and the Arts.

No. 2614, a power loom for bed ticks, made by James Brooks, of Frankford; a neatly made loom, not differing materially from those in use. There are, however, one or two improvements in some of the details, which induce us to award it A Silver Medal.

No. 2612, a lot of platform scales, by J. D. Dale, of Lansingburg, New York, apparently more complicated, and not so neatly made as some others in the exhibition.

No. 2568, bonnet pressing machine, by W. H. Howard & Son, Philadelphia; this very meritorious machine came too late for competition at the last exhibition, and the judges had to regret that they could not recommend the award of a premium. That difficulty does not now exist, and the present committee have pleasure in carrying out the views of their predecessors in office, by awarding it

A Silver Medal.

No. 2575, a neatly made model of the Fair Mount Engine, by Mason, not, however, superior, we think, to other specimens at former exhibitions, by the same hand.

No. 2576, two tobacco presses, by Charles Evans; these are very simple and powerful presses, extremely well adapted to the purpose to which they are applied. They were not made for the purpose of being exhibited, but were taken from the workshop just as they are made for sale. They have been fitted up with as little work as possible, without any attempt at finish; the working parts are fitted, but the strictest economy has been used throughout, and no work that was not absolutely necessary to make them serviceable has been put upon them; we award them A Certificate of Honorable Mention.

No. 2578, a patent swingle-tree, made by Mr. Kinsey, of Berks county, Penna., an ingenious contrivance, but not quite as simple as others in use.

No. 2618, a carriage brake and swingle-tree, made M. S. Woodward, Chester county, Penn.; the brake is so arranged that the thrust, or pressure, necessary to force the brakes against the periphery of the wheel, is made to react upon the axle instead of the carriage body. Any objectionable stress upon the springs which sustain the body, is by this arrangement wholly avoided. The detaching swingle-tree is simple, and, we think, will answer a good purpose. The ingenuity evinced in these two contrivances, we think, merits the award of

A Certificate of Honorable Mention.

No. 2626, a type making machine, made by L. Johnson, of Philadelphia, invented by D. Bruce, of New York; this is an exceedingly ingenious machine, by means of which one man will do the work of three, or more. By simply turning a crank, types are made in the most perfect manner, at the rate of from one hundred to one hundred and twenty per minute. This is probably the most interesting machine in the exhibition, and we think it well deserves the award of a medal. We hope that the inventor will also submit it to the Committee on Science and the Arts, in order that its merits may be more

fully examined, and made known; we award to Mr. Bruce, for the invention, A Silver Medal.

No. 2632, a printing press, by Cosfeldt, of Philadelphia; this is, in form, the same as the Washington press, and only differs from it in having one member of the toggle joint made longer, so as to give more pressure; it is, however, a good and serviceable machine.

No. 2708, a machine for printing calicoes, made by Marshall & Brock, of Philadelphia, deposited by Thomas Hunter, which is neat and substantial, and gives evidence of being efficient for its purpose.

A Certificate of Honorable Mention.

The committee feel indebted to Messrs. Marshall & Brock, for the display of a series of cotton cloths, showing clearly the numerous steps in the process of preparing, dyeing, and printing on fabrics of cotton.

No. 2646, a dynamometer, invented by Samuel Batchelder, of Saco, Maine, made by Howe & Goddard, of Worcester, Mass., is a very ingenious instrument for measuring the power required to drive small machines, such as looms, cards, &c.: for its ingenuity and efficacy we award it A Certificate of Honorable Mention.

No. 2682, a paper cutter, by A. L. Knight, of Philadelphia; this machine is used as an adjunct to the modern machines, which make paper in endless pieces, and cuts those pieces as they come from the reel, into the proper commercial sizes.

A Certificate of Honorable Mention.

No. 2693, the New Market Fire Engine, built by John Agnew, is like all the products of his shop, a most admirable specimen of finish and efficiency.

No. 2517, box machine cards, made by J. & L. Woodcock, of Leicester, Mass.; a very good and well made article.

No. 2510, jointless wire harness; we are not informed how this kind of harness answers in practice, and cannot speak of its merits. We would suggest its reference to the Committee on Science and the Arts.

No. 2561, a loom, made by H. H. Bottom & Co., Trenton, N. J., and deposited by A. W. Tiffany, of Philadelphia; a very well made and finished piece of work. A Certificate of Honorable Mention.

No. 2571, machine cards, very well made, by Sellers & Pennock, of Philadelphia.

No. 2577, a mitreing machine, by W. B. Saurman, of Philadelphia; this has a clamp for adjusting and holding a piece of wood to be mitred, or beveled. It has a quadrant and index attached, by means of which the piece can be cut at any desired angle. It is well devised for the purpose. A Certificate of Honorable Mention.

No. 2600, last turning machine, made by S. S. Chase, of Philadelphia; this appears to be a very well arranged and effective machine; by it lasts of many different sizes may be made from the same model last. The committee do not know that any novelty in the principle of the machine is claimed, they would, however, suggest to the maker that it be submitted to the Committee on Science and the Arts. We award it A Certificate of Honorable Mention.

To Thomas J. Wells, of New York, for No. 2629, a rotary dovetail and tenoning machine, being, in fact, a lathe for turning first a cylinder, and then converting the end of that cylinder into a dovetailed tenon of rectangular section with great accuracy and rapidity. We award

A Silver Medal.

This very ingenious machine has been much employed in N. York, and other places, for cutting dovetailed tenons of square section upon the feet of banisters, &c.; it is neither complicated nor likely to get out of order readily, and for its ingenuity, efficiency, and simplicity, commands the admiration of this committee.

To Garrett B. Davis, of Philadelphia, for an improved chimney cowl, which was successfully applied, during the exhibition, to augment the draught of one of the flues; we award

A Certificate of Honorable Mention.

No. 2630, a paper ruling machine, by Charles H. Kerk, of Philadelphia; a very complete and perfect machine.

A Certificate of Honorable Mention.

Some very thin sheet lead, by Tatham & Brothers, is very beautifully made indeed.

Notwithstanding the unusual extent of space which we have devoted to noticing this important department, the committee nevertheless fear that, amongst the numerous objects attracting their attention, they may possibly have overlooked some articles of importance which really merited a minute observation.

We have now to present our acknowledgments to Matthias W. Baldwin, one of the managers of the Institute, for the small steam engine and boiler now employed to drive the working machinery in the lower saloon. This engine is executed in the usual neat style which marks the products of Baldwin & Whitney's factory, and combines that ingenious arrangement of slide and pump which is peculiar to engines of Mr. Baldwin's design, and has been the frequent subject of admiration amongst mechanics. Mr. Baldwin being a manager, cannot, under our regulations, receive any premium for this simple and meritorious machine.

XI.—Stoves, Grates, &c.

The display of these very useful articles has been unusually fine. We notice in several instances new and useful forms, and, on the whole, we think there is a decided improvement, both in workmanship and in the taste with which the articles generally have been designed. Agreeably to the recommendations of the judges, we make the following awards:—

No. 2528, a range for cooking with anthracite coal, made by Julius Fink, of Philadelphia.

A Certificate of Honorable Mention.

No. 2530, a similar range, in some respects, made by Lloyd & Feltwell, appears to act very well.

A Certificate of Honorable Mention.

No. 2506, a cooking stove, by Thomas Durell, of Philadelphia.

A Certificate of Honorable Mention.

No. 2592, a cooking stove, by J. Kisterbock, of Philadelphia.

A Certificate of Honorable Mention.

No. 2603, an assortment of very neat and useful stoves, by J. L. Mott & Co., of New York. A Certificate of Honorable Mention.

No. 2527, two cooking stoves, by Cluet & Billings, of Philadelphia, of Douglas' patent, of New York. A Certificate of Hon. Mention.

The judges notice, in a highly favorable manner, No. 2572, a large assortment of excellent stoves, by Færing & Thudium, of Philadelphia; No. 2604, an octagonal radiator, of unique design, by Williams & Hinds; Nos. 2606 and 2563, two very neat stoves, by H. G. Bartles, of Philadelphia; a cooking stove, made by Marks, of Boston, and deposited by D. O. Prouty; No. 2548, a radiator stove, by Evans & Watson; and No. 2569, a cooking stove, made by F. H. Church, and deposited by Mr. Tuttle: also, the small anthracite coal cooking stove, made by Færing & Thudium, at the instance of the Union Benevolent Society, and designed expressly for the use of the poor.

In conclusion, the committee express the pleasure with which they notice the complete success which now appears to attend the kitchen ranges and stoves for cooking with anthracite coal as fuel, and, in fact, a number of these contrivances seem to be almost perfect.— Though there appears to be a great variety in form amongst the cooking stoves, the committee are informed by the judges, "that they agree very closely in point of economy of fuel, and general convenience."

XII.—*Cabinet Ware.*

The specimens of Furniture, were, many of them, highly deserving for taste in the design, and elegance in the workmanship.

The beautiful examples of various articles of cabinet ware, made by the Messrs. Crout, of Philadelphia, from American woods, attracted great attention. They deserve our commendation, and having heretofore received a medal, we award them now

A Certificate of Honorable Mention.

We also make the following award:—

No. 2070, a therapeutic chair, designed for the use of the sick, very ingeniously contrived, and handsomely finished.

A Certificate of Honorable Mention.

The judges deservedly speak in strong terms of praise of No. 2011, fancy reed blinds, by Martin Free, of Philadelphia; No. 2012, wardrobe, dressing glass, and two centre tables, by John Barr & Co., of Philadelphia, are very elegant articles; No. 2027, one marble table, by H. G. Douglass, of Philadelphia; No. 2033, two pair of Venitian blinds, by B. J. Williams, of Philadelphia, are very neat and well made articles, worthy of the maker's reputation; No. 2060, one sofa table, and a pier table, by A. Miller & Co., of Philadelphia, are very fine articles; No. 2076, a wardrobe, of superior finish, by Moore & Champion; No. 2013, a dentist's chair, by William Foster, of Trenton, is a very excellent article, but came too late for competition.

The committee have observed with pleasure, and feel bound to notice with approbation, the cabinet work of No. 211, a very beautiful piano, made from American birch, by the Philadelphia company, which came too late for competition.

XIII.—Musical Instruments.

The number of Piano Fortes now exhibited is smaller than it has been for several years past, and the improvement which they indicate is not remarkable. Several of the instruments, however, are of excellent character, well made, and, in all respects, such as to confirm the opinions heretofore expressed in favor of the establishments from which they come. Those from Mr. Gale, of New York, and deposited by J. C. Smith, of Philadelphia, and Meyer, of Philadelphia, are of this class.

Agreeably to the opinions of the judges, the committee make the following award:—

No. 2028, an improved double action harp, made by J. F. Browne, of New York, and deposited by A. Fiot, of Philadelphia; in its plan, workmanship, tone, and appearance, worthy of very high praise.

A Silver Medal.

This beautiful harp, having upon it a foreign mark, the judges doubted whether it was really of American make, and to determine this important fact, they opened a correspondence with the maker, who forwarded sufficient sworn testimony to prove its having been made in New York, and marked in a foreign fashion, merely to meet a prejudice existing in the market in favor of foreign articles of this kind. With this positive evidence before us, relative to its origin, we join most cordially in the very warm commendations bestowed by the judges upon this truly elegant article.

XIV.—Glass and China.

The specimens of this beautiful and interesting department, though chiefly confined to Glass Ware in small quantities, have been very choice, and display decided improvement. The pressure of orders in the glass factories has prevented many of the manufacturers from sending hither any great number of articles for exhibition. Conformably to the opinions of the judges, we make the following awards:—

No. 1036, glass ware, made by M. & R. H. Sweeney, of Wheeling, Virginia, deposited by Joseph Bell, and comprising one very large and beautiful bowl, fruit bowls, celleries, pitchers, decanters, tumblers, and wine and jelly glasses, all of uniform quality, richly cut, and remarkably clear and brilliant.

A Silver Medal.

No. 1051, by the Boston and Sandwich Glass Company, deposited by W. M. Muzzy, of Philadelphia, a lot of colored glass, far surpassing any before exhibited here, the colors being the most perfect and delicate we have yet seen, and the opaque glass being very skilfully made.

A Silver Medal.

The manufacture of colored glass is of recent origin in this country, and it is highly gratifying to witness the degree of excellence already attained by the Boston and Sandwich Glass Company.

No. 2101, two painted porcelain cups, by M. Strasser, of Philadelphia; these paintings are creditable specimens of art, the colors being good, and the execution superior.

We award to M. Strasser, for No. 2101, a Certificate of Honorable Mention, and we cannot but express a regret that the manufacture of

porcelain, and its accompanying art, painting by fire colors, have not hitherto proved successful in this country.

XV.—*Books and Stationary.*

In this branch of art, though the specimens were not very numerous, some of them were strikingly beautiful, and we make the following awards to the most deserving, in our opinion:—

For the beautiful polychromic lithography, executed in the upper saloon, by Pinkerton, Wagner & M'Guigan, artists in this elegant branch of colored printing from stone, which was deservedly admired by all who witnessed it. *Five* different colors have been successfully employed by them in the same piece, and for the finished execution displayed in this recently introduced branch of art, we award them

A Silver Medal.

No. 24, a volume of "Les Jardine des Plants," bound by J. David, of Philadelphia; for the superior perfection of the series of lines executed in the binding,

A Silver Medal.

No. 210, the set of "Indian Biography," in this lot, bound by Lippincott & Co., of Philadelphia, deposited by T. B. Wells; for the general execution of so large a volume,

A Silver Medal.

No. 210, for the beautiful specimens of velvet binding, in this lot, by Lippincott & Co., of Philadelphia, deposited by them,

A Certificate of Honorable Mention.

No. 41, books, from Lindsay & Blakiston, of Philadelphia; a certificate of honorable mention has been recommended by the judges, but Mr. Lindsay, being a member of this committee, cannot receive it.

No. 144, a beautiful lot of hand made writing paper, made by Wilcox & Co., of Delaware county, Pennsylvania.

A Certificate of Honorable Mention.

No. 146, a lot of parchment, a very good article, by Preston Marshall, of Philadelphia.

A Certificate of Honorable Mention.

The judges speak favorably of No. 84, a lot of books from the Sunday School Union; No. 150, the engraving and binding of the Pilgrim's Progress, by the Presbyterian Board of Publications; No. 211, a variety of books, bound in different styles, with great skill and taste, by D. W. Gihon, of Philadelphia.

As bearing relation to this department, the committee take occasion in this place, to express their sincere thanks to T. F. Adams, for his enterprise in establishing a printing press in the lower saloon, and displaying to the visitors the process of composing, printing, and disposing of a newspaper—by the actual publication, during the exhibition, of a little sheet called "*The Fair*," which attracted great attention, and displayed, on the part of all connected with it, an intimate knowledge of the details of conducting this miniature of the mighty engine of civilization. We take pleasure in awarding him

A Certificate of Honorable Mention.

XVI.—*Paper Hangings.*

Of these articles none have been this year offered for exhibition, notwithstanding the fine opportunity our saloons have offered for

displaying to the greatest advantage every variety of wall paper. This is to be regretted, since we have had other means of ascertaining that this branch of business has attained a degree of excellence which would justify the exposure of its products with advantage to the criticism of any community.

XVII.—Fine Arts.

With a single exception, the specimens of the Fine Arts exhibited, are not very meritorious, neither are they very numerous. We make the following awards:—

No. 2063, an American eagle, carved from Italian marble, by John Hill, and designed to adorn the tomb of the late distinguished Commodore Hull, now being constructed by the Messrs. Struthers, is, in all respects, worthy of its destiny, and forms one of the most exquisite pieces of American carving which we have ever witnessed. We take the greatest pleasure in awarding to the able artist who executed it
A Silver Medal.

No. 2040, stucco work, by a pupil of the High School of Philadelphia, is very praiseworthy, and we award it

A Certificate of Honorable Mention.

No. 2004, Daguerreotypes, by Plumbe; No. 1014, do. by Langenheim, and No. 2029, by Root & Collins, all possess a very high degree of merit, and we award to each A Certificate of Honorable Mention.

To Van Loan, of Philadelphia, for some very perfect Daguerreotype pictures, decidedly the best ever exhibited here, we award

A Silver Medal.

The judges notice very favorably, three oil paintings, by W. Gould; a good likeness, by Veron Fletcher; landscapes, by Austin Street; a landscape, by G. W. Holmes; and a beautiful specimen of penmanship, by Ross. This committee have examined with great pleasure two bold and elegant pen drawings, Nos. 2023 and 2026, the former by J. Snyder Leidy, and the latter by B. Eakins, both of Philadelphia. There are other creditable specimens, not, however, requiring minute notice.

XVIII.—Silver Ware and Jewelry.

As usual, some very beautiful specimens of Silver Ware have been brought forward by our artizans in that line, and we make the following awards:—

No. 2709, a silver cased chronometer, made by Wm. E. Harpur, is a very neat, beautiful, and, apparently, accurate piece of mechanism; it is entirely of American manufacture, and we award it

A Silver Medal.

No. 1079, a lot of silver ware, made by Bailey & Kitchen, of Philadelphia, containing several articles of superior excellence, particularly a plain pitcher; the whole forming a beautiful display.

A Silver Medal.

The committee notice, with great pleasure, a fluted tea set, by R. & W. Wilson, of Philadelphia, which has been much admired, and fully sustains their high reputation.

The chronometer referred to above, contains several novelties in the construction of the lock, and detent and helical spring.

XIX.—*Bookbinders' Tools.*

The judges express considerable approbation of several of the specimens deposited in this department, and, agreeably to their opinions, we make the following awards:—

No. 56, a lot of copper plates, for engravers, by J. Juery, of Philadelphia. A Certificate of Honorable Mention.

No. 69, very fine specimens of gold leaf, by Otter & Gihon, of Philadelphia. A Certificate of Honorable Mention.

No. 167, specimens of edge gilding, by G. Eckendorf, of Philadelphia. A Certificate of Honorable Mention.

No. 172, a case of specimens of edge gilding, of very fine quality, by James P. Rice, of Philadelphia.

A Certificate of Honorable Mention.

No. 169, impressions of the dies exhibited as No. 168, by Gaskill & Copper, of Philadelphia, are beautiful specimens of the most finished workmanship.

A Certificate of Honorable Mention.

No. 2025, a set of dies and embossing plates, by A. C. Morin, of Philadelphia, fully equal to any before exhibited.

A Certificate of Honorable Mention.

The judges speak very highly of No. 168, dies and other ornamental tools, by Gaskill & Copper, of Philadelphia; and this committee award to them, as the most deserving of their class,

A Certificate of Honorable Mention.

XX.—*Marble Work.*

Of Marble Work, we regret to say, that notwithstanding the well known excellence of our artizans in this line, but few specimens have been brought forward, and those few are not of a sufficiently high grade of merit to justify us in awarding them the honors of the Institute.

XXI.—*Hats and Caps.*

The visitors to the present exhibition have, through the enterprize of Charles Oakford, one of our most experienced manufacturers, enjoyed the advantage of witnessing, in the lower saloon, the actual fabrication of hats in nearly all their processes, and the practical manipulations of this ingenious art have deservedly attracted considerable attention. The hats exhibited on this occasion, undoubtedly show a very high degree of finish, and appear to us rather to surpass the specimens shown at any former exhibition. The judges have made a minute report, from which we have decided on the following awards:—

No. 1503, a black beaver hat, and a black silk hat, both superior in material, make, stiffening, and finish, by Charles Oakford, of Philadelphia. A Silver Medal.

The silk hat, in particular, being, in the opinion of the judges, the best exhibited; but it not being customary with us to award two

medals to the same person in the same industrial branch, therefore, we have awarded to Mr. Oakford but one.

No. 1606, a black beaver hat, made by John C. Yeager, of Philadelphia, which is a very creditable article.

A Certificate of Honorable Mention.

No. 1503, a white beaver hat, of elegant style and finish, by Chas. Oakford, of Philadelphia.

A Certificate of Honorable Mention.

No. 1515, a black nutria hat, made by Orlando Fish, of New York, which is a very beautiful article.

A Certificate of Honorable Mention.

No. 1606, a black nutria hat, made by John C. Yeager, of Philadelphia, in a very fine style and finish.

A Silver Medal.

No. 1515, two black silk hats, by Orlando Fish, of New York, pronounced by the judges to be very superior; the committee award

A Silver Medal.

There were also exhibited several muffs, boas, and caps, which, in the opinion of the committee, are of very admirable construction and finish.

XXII.—*Combs and Brushes.*

The judges declare the opinion that the workmanship of the articles in this department sustains very fully the reputation of the artisans in this branch of industry. The committee make the following awards—

No. 1566, one case and three cards of brushes, by C. D. Thum, of Philadelphia; these are all very creditable, and some of them very superior articles, both in materials and workmanship.

A Silver Medal.

No. 1547, brushes, &c., made by the blind at the Pennsylvania Institution, in Philadelphia; these articles possess no peculiar merit merely as brushes, but as brushes made by persons deprived of sight, they are truly creditable, and well deserve

A Certificate of Honorable Mention.

Nos. 1512, 1523, 1828, and 1599, consisting of combs, made by A. Simpson, T. Simpson, Jonas Colburn, and P. C. Noyes, though not particularly prepared for exhibition, were deservedly admired, and, in our opinions, justly add to, and are worthy of, the reputation of their makers.

The judges speak approvingly of No. 1541, a lot of fancy bellows, of very good quality.

XXII.—*Coach Work.*

The specimens in this department, though not very numerous, evince, we think, the fact, that this manufacture has also progressed during the past year. Several very creditable articles came too late for competition, or notice, by the judges. We make in this branch the following awards:—

No. 1270, a substantial and beautifully finished coach, made by Vansciver & Son, of Philadelphia, attracted general attention, it deserves great credit for the skill and taste displayed in its construction

and would certainly have received the highest premium in this branch of art, if it had come in time for competition.

No. 2597, a Rockaway chariottee, of very good materials and workmanship, by Vansciver & Son, of Philadelphia.

A Certificate of Honorable Mention.

XXIV.—*Leather and Morocco.*

It has been very justly remarked, that this is a most important manufacture—in fact, very few are more so—and it gives us much pleasure to learn from the judges, that in several of its branches very decided improvements have been made over the showing of former years. These improvements, and the general excellence of the numerous specimens displayed, justify the following awards:—

No. 530, Japanned leather, by the Boston Manufacturing Company, deposited by J. W. Patten, of Philadelphia, displaying a clear superiority over similar articles formerly exhibited.

A Silver Medal.

No. 543, binding skins, by Robert Emes, of Abington, Pennsylvania, pronounced to be a very superior article, and deposited by D. C. Spooner, of Philadelphia.

A Silver Medal.

No. 584, bag hides, tanned by C. B. Williams, of Philadelphia, and finished by Wm. F. Forepaugh, are very fine samples of a most valuable kind of leather, and, for the finishing, we award

A Silver Medal.

No. 2545, sole leather, tanned by C. B. Williams, of Philadelphia, a very fine article indeed.

A Silver Medal.

No. 2559, sole leather, tanned by Wm. H. Crawford, of Philadelphia; also a very excellent specimen of its kind.

A Silver Medal.

No. 575, russet bridle leather, and some well tanned bag hides, showing good workmanship, made by Scattergood & Bousted.

A Certificate of Honorable Mention.

The following articles, for their workmanship, and apparently excellent quality, deserve high praise, but were not thought to possess a superiority quite sufficiently marked to entitle them to premiums, though better specimens are not frequently to be found in the general market, viz:—

No. 2651, a very fine and large enameled chaise hide, tanned by H. & G. Fricke, of Philadelphia, which came too late for competition.

No. 2650, an unusually large and well finished chaise hide, of the old style, by Pyle & Co., of Wilmington, Delaware, attracted much notice, also too late for competition.

No. 147, a lot of remarkably well tanned and finished sheepskins, in the wool, by Thomas Clough, of Philadelphia, which are certainly very creditable to the workmen.

The calf-skins and moroccos exhibited, are certainly very fine, but do not seem to possess a very marked superiority over the products of past years.

XXV.—*Boots and Shoes.*

These very important products of industry exhibit, the present

year, very great beauty of workmanship, combined with great apparent excellence of material; in fact, the specimens now on deposit superadd to a very neat finish, strong promise of durability. In accordance with the opinion of the judges, we make the following awards:—

No. 226, one case of ladies' boots and shoes, by William Ryan, of Philadelphia, samples of fine dress articles, the quality and style of which are much commended by the judges. A Silver Medal.

No. 514, a pair of ladies' gaiter boots, made by J. Rottenbury, and deposited by McIntosh, of Philadelphia, esteemed to be a very excellent article. A Certificate of Honorable Mention.

No. 550, three pair of gentlemen's fine boots, by L. Benkert, of Philadelphia, of admirable workmanship, and decidedly the best exhibited. A Silver Medal.

No. 588, two pair of gentlemen's boots, by C. Benkert, of good and durable quality, and neat fashion.

A Certificate of Honorable Mention.

The judges notice in terms of approbation, as neat and serviceable articles, No. 533, five pairs of boots, deposited by John Ryan, of Philadelphia, and No. 538, nine pairs of boots, deposited by Joseph Hill, of Philadelphia; we award to both

Certificates of Honorable Mention.

Some kid shoes, spring clogs, lasts, and other articles, deposited by various parties, appear to be well made, but not sufficiently distinguished to require a more minute notice.

XXVI.—*Chemicals, &c.*

The chemical articles exhibited display a variety and excellence which is very gratifying. The chemicals of commerce, manufactured upon a large scale for the general market, show a decided improvement, and the specimens of them now exhibited deserve and receive the highest approbation from this committee. The chemists who formed the board of judges in this division, have made a minute report, in conformity to which the following awards have been decided on:—

No. 551, commercial chemicals, by Farr, Powers & Weightman, of Philadelphia; a very admirable display of superior articles.

A Silver Medal.

No. 536, chemical preparations, by Smith & Hodgson, of Philadelphia; a very beautiful lot of specimens.

A Certificate of Honorable Mention.

No. 518, prepared spermaceti, by Alexander H. Campbell, a most superior article.

A Certificate of Honorable Mention.

No. 549, the best perfumery, prepared by Eugene Roussel.

A Certificate of Honorable Mention.

No. 522, to Jules Hauei, of Philadelphia, for decided improvements in perfumery since last year, A Certificate of Honorable Mention.

No. 528, transparent soap, by H. P. & W. C. Taylor, of Philadelphia, a truly elegant article. A Certificate of Honorable Mention.

No. 564, common soaps, by J. R. Graves, of Philadelphia, of the

kinds usually employed in the arts; in consideration of superior quality, cheapness, and their production on a great scale,

A Silver Medal.

To Roussel, of Philadelphia, the well known perfumer, for mineral water, made in stone, or glass, vessels, and therefore, entirely free from any taint of copper; we award

A Certificate of Honorable Mention.

The judges notice in terms of approbation the following articles:—

Extract of indigo, by A. Gund; Barnhill's indelible ink, by Potts, Linn & Harris; sugar, (refined) by Lovering & Co.; chemicals, by Dillwyn Parrish; magnesia, calcined and fluid, by Thomas J. Husband; chemical preparations, by J. Taylor; oils of hemp seed and peach kernels, by Edward Ryan; cyanide of potassium, by H. Worthington; chemicals, by William Proctor, jr.; Seidlitz powders, by Haskell & Merrick; mustards and spices, by Messrs. Fell; chemicals, by Edward Parrish; pine oil, or camphine, by Benjamin T. Davis, a very fine article; isinglass, by Delacour; chocolate and cocoa, by J. Schmitz; starch, by Altemus; polishing rouge, by Mrs. West; perfumery, by Hinton, and by Wetherill.

Many of these articles really possess great merit, and the committee think a slight, but marked, superiority over similar specimens hitherto exhibited. The extreme beauty of the refined sugars, manufactured by Joseph S. Lovering & Co., of Philadelphia, challenged our highest admiration, and we only suspend the award of a silver medal to them, in order to give time for a minute examination by a special committee. In like manner we propose to have some tests made of the fine indelible inks of Potts, Linn & Harris, with the view of awarding them a certificate of honorable mention, if the results should be such as we anticipate. We also propose, with the same object, to submit Messrs. Haskell & Merrick's Seidlitz powders to a sufficient test.

XXVII.—*Philosophical Apparatus.*

The display of Philosophical Apparatus, is not, this year, so extensive as it might have been made, by a little more exertion on the part of the artizans in this branch; nevertheless, those specimens which are deposited must be regarded as very creditable. Agreeably to the sentiments of the judges, we make the following awards:—

No. 2710, an analytical balance, by J. P. Duffy, of Philadelphia, is very neatly finished, judiciously mounted, and, on a test by the judges, turned sensibly with the half of a millionth part of its load; we award it

A Silver Medal.

Nos. 1016 and 1025, fine specimens of mechanical, optical, and electro-magnetical apparatus, by J. P. Duffy, of Philadelphia.

A Certificate of Honorable Mention.

* Nos. 1126 to 1128, electrical and electro-magnetical apparatus, made by J. Bishop, of Philadelphia.

A Certificate of Honorable Mention.

To A. Prince, optician, of Philadelphia, for some very well executed Stanhope lenses, believed to be the first ever made in this country, we award them

A Certificate of Honorable Mention.

No. 1045, the perifocal spectacles of H. M. Paine, of Mass., deposited by E. Borhek, of Philadelphia, appear to be well made, and are pronounced to be very superior in numerous certificates. They should, we think, be referred to the committee on Science and the Arts.

No. 2623, counter scales and prescription balances, made by T. Meyer & Co., and deposited by Gray & Brother, appear to be well proportioned and finished.

The brass clock, No. 1033, by C. Gilbert, is a fair specimen of these useful and very cheap meters of time.

XXVIII.—Straw Goods.

We are happy to have it in our power to state, that in this department the judges announce a very decided improvement over the products of former years; and, agreeably to the opinion expressed by them, we announce the following awards:—

No. 1534, edgings for bonnets, made of hair and straw, twenty-two pounds in all, manufactured by Joseph Weed, of Philadelphia, an article deserving the highest praise as a domestic fabric; made entirely of material the growth and production of this country, and, as being, in fact, superior to any thing of the kind, foreign, or domestic, heretofore put on sale in our market. A Silver Medal.

No. 1603, bonnet wire, by James Bird, of Philadelphia, very elastic, and beautifully covered with silk, in various styles.

A Certificate of Honorable Mention.

The judges also notice with approbation, some very good specimens of dyeing on straw goods, by James Bird, of Philadelphia.

XXIX.—Surgical Instruments.

In this department, pursuant to the recommendations of the judges, we make the following awards:—

No. 2043, a case of porcelain teeth, deposited by Dr. E. Wildman, of Philadelphia, which have successfully stood the tests applied by the judges. A Silver Medal.

No. 1019, table for dental instruments, made by Henry Habermehl, of Philadelphia, of excellent workmanship, and very conveniently arranged. A Certificate of Honorable Mention.

No. 1078, a set of dental instruments, by Jacob H. Gemrig, of very fine workmanship and finish. A Certificate of Honorable Mention.

No. 1099, a lot of emery composition, grindstones, and whetstones, deposited by Samuel S. White, of Philadelphia, deserve a certificate, but came too late.

No. 1064, a lot of artificial teeth, deposited by Goodwin & Mitchell, of Philadelphia, deemed by the judges to be very creditable.

A Certificate of Honorable Mention.

The judges notice favorably, No. 1041, a case of porcelain teeth, deposited by Crispenn & Henck, of Philadelphia; No. 1049, a case of artificial teeth, deposited by A. R. Johnson, of Philadelphia; No. 1067, a grinding machine, deposited N. L. Dickey, of Philadelphia; a drill, in case No. 1067, is referred to as being very ingenious; No.

1093, a lot of artificial teeth, deposited by John M. Crowell, very good in every point except vital appearance.

XXX.—*Gum Elastic Goods.*

In this branch of manufacture, which, as is well known, has not been very long established, the committee hail with satisfaction a very decided improvement. The judges, in a very minute report, speak in the strongest terms of favor of the Caoutchouc manufactures of Mr. Goodyear, and, in conformity to their opinions, we make the following awards:—

No. 511, a lot of three trunks full of India rubber goods, made by Charles Goodyear, of Naugatuck, Conn., deposited by Dulles, Aertson & Fisher, and comprising a great number of articles of utility made from gum, so prepared and laid on textile fabrics as to preserve in the highest degree, its peculiar properties under all the vicissitudes of heat, cold, and moisture in our climate. A Silver Medal.

No. 541, a case of admirably made India rubber shoes, manufactured by John L. Ripley, of Philadelphia.

A Certificate of Honorable Mention.

The judges notice favorably, No. 501, a case of India rubber articles, made by Horace H. Day, and No. 529, ditto, manufactured by the Hotchkiss and Merrimac Manufacturing Company.

In conclusion, the committee are much gratified to see the continual new applications which are being made of this most interesting manufacture.

XXXI.—*Copper, Brass, and Plumbers' Work.*

A number of meritorious articles of Brass, and Plumbers' work were brought in too late for examination by the judges, and we regret therefore, that they cannot receive the notice they deserve. We make in this department the following awards:—

No. 2576½, one large church bell, of very admirable tone, made by Lewis Debozeur, of Philadelphia.

A Certificate of Honorable Mention.

Some braziers' solder deposited, is well spoken of by the judges.

XXXII.—*Tin Work.*

The judges in this department, in a minute report, have detailed the various articles, and their merits, of many of which they speak very highly. It appears that Williams & Co., of Philadelphia, are the chief depositors in this branch, and the committee are gratified in making the following award:—

No. 2605, by Williams & Co., of Philadelphia, an extensive lot of household articles, comprising most of the articles of tin ware in common domestic use, and the whole of which are well fashioned, substantially made, and skilfully finished. A Silver Medal.

In this lot of tin ware the judges take especial notice of some very well arranged and well constructed portable shower baths; they also speak favorably of Johnson's patent ice-cream freezer, of which it seems that extensive sales have been made, giving much satisfaction to the purchasers.

XXXIII.—Paints and Colors.

In these very useful articles the committee think they notice some decided improvement, and, agreeably to the recommendations of the judges, who have given to the various specimens that minute examination requisite for the formation of correct conclusions in such cases, we make the following awards:—

No. 515, white and red lead, by George Uhler, of Philadelphia, to the former for its superior whiteness, fineness, and body, to the latter for its depth and brilliancy of color. A Silver Medal.

No. 579, lamp black, by Thomas Matlack, of Philadelphia, for its superior blackness, fineness, and purity, would have received a certificate if it had arrived in time.

We notice also, as deserving of high praise, the vermilion by Farr, Powers & Weightman, of Philadelphia.

XXXIV.—Fancy Articles.

The number of articles in this branch, submitted to the judges, is not so large as in previous years, a new committee having been appointed on "Clothing and Needlework," which division comprises many articles formerly placed among "Fancy Goods."

The committee on fancy articles have observed, with much interest, the increase in the manufacture of a vast number of articles in this department, formerly mostly imported from Europe, such as toys, artificial flowers, and various other things, both useful and ornamental, which, if made in our own country, would afford means of support to many an industrious female and aged person.

The committee notice with particular commendation, No. 1509, a case of artificial flowers, made and deposited by James D. Brown, of Philadelphia, manufactured of foreign material, but displaying a beauty in form and design surpassing any ever exhibited. They deem these flowers worthy A Certificate of Honorable Mention.

No. 1536, a case of wax fruit, by Miss M. George, is beautifully executed, and worthy A Certificate of Honorable Mention.

No. 1540, a case of wax fruit, by Miss C. A. Smith, is very well made, and deserves commendation.

No. 1545, a national flag, made entirely of American silk, is a rich and beautiful article; the committee awarded to W. H. Horstman, of Philadelphia, the maker, A Certificate of Honorable Mention.

No. 1552, a lot of fly brushes, displaying great taste and skill in the manufacture, made by Jacob Wilt, is judged to deserve

A Certificate of Honorable Mention.

No. 1617, a very large assortment and variety of bottled pickles, tastefully disposed upon a stand in imitation of a temple of liberty, surmounted by an American eagle, is a conspicuous object in the exhibition, and has been much admired. The depositor, T. B. Smith, obtained a medal at the exhibition of last year; but for the improvement in the design of his display, as well as for the excellence of the articles deposited this year, the committee think him entitled to

A Certificate of Honorable Mention.

No. 1571, a case of fancy baskets, by Miss A. Williamson, a neat, convenient, and beautiful article, worthy of

A Certificate of Honorable Mention.

No. 1583, a case of splendid wax fruit and flowers; among the flowers is an admirable imitation of the *Nelumbium Luteum*, a rare and beautiful flower, which we have never before seen attempted; to the maker, Mr. C. Girdon, is awarded

A Certificate of Honorable Mention.

To some beautiful bronze castings of miniature statues of Washington, Napoleon, and Guttemberg, by Mr. Doflein, who obtained a premium at the last exhibition, we award

A Certificate of Honorable Mention.

To Mr. and Mrs. Burns, of the Franklin Female Institute, Chambersburg, Penna., for a very novel and beautiful map of the State of Pennsylvania, executed in lace work, and showing each county in a different stitch, we award

A Certificate of Honorable Mention.

To some very elegant French plaiting, No. 1542, by Madam Juery, of Philadelphia, we award

A Certificate of Honorable Mention.

The committee regret that many meritorious articles in this branch of the exhibition were brought too late to come under the notice of the judges.

XXXV.—Household Articles.

In this department, comprising the miscellaneous articles of domestic comfort which scarcely come within the scope of other regular industrial divisions, the committee notice with pleasure a number of articles, the comfort and convenience of which they have already, in their private relations, had an opportunity of testing.

On the basis furnished by the examination of competent judges, we make the following awards:—

To Oliver Evans, of Philadelphia, for No. 2504, a provision chest, containing a refrigerator and water filter, the whole being arranged upon a good plan, and the workmanship being decidedly superior to any thing of the kind now exhibited.

A Certificate of honorable Mention.

No. 2543, articles of cedar ware, by Samuel Tompkins, of Philadelphia.

A Certificate of Honorable Mention.

No. 2548, refrigerators and provision safes, made by Evans & Watson, of Philadelphia, lined with slate, which are very superior articles.

A Certificate of Honorable Mention.

No. 2565, brooms and hearth brushes, by Manly Rowe, of Philadelphia, being most excellent articles.

A Certificate of Honorable Mention.

No. 2588, willow baskets, by W. D. Hart, of Philadelphia, esteemed to be very good of their class.

A Certificate of Honorable Mention.

The judges speak very favorably of No. 2610, a table, a roaster, and a churn, all very useful articles, by Gideon Cox, of Philadelphia; No. 2631, bread, baked by F. S. Reed, of Philadelphia; and finally, to No. 2538, two barrels of flour, both good, but that made by James

Patterson, of Brighton, Penn., being a very superior article; we award the latter A Certificate of Honorable Mention.

No. 2573, brooms and wooden ware, by George Chipman, of Philadelphia. A Certificate of Honorable Mention.

No. 2555, wooden ware, deposited by E. H. Jones.

A Certificate of Honorable Mention.

XXXVI.—*Clothing and Needlework.*

In this comparatively humble, yet extremely important branch of economical industry, we observe with pleasure quite an extensive display of articles, the great majority of which are very creditable to the hands who fashioned them. To those of the most particular merit, in the opinion of the judges, we make the following awards:—

No. 1580, two scarfs, very well made, by J. D. Brown, of Philadelphia. A Certificate of Honorable Mention.

No. 1591, a case of shirts, by G. W. Ward, of Philadelphia, the best exhibited, especially in the cutting and fitting.

A Certificate of Honorable Mention.

No. 1592, a coat made by Francis Mahan, in all respects very well done. A Certificate of Honorable Mention.

No. 1595, a piano cover, made by Margaret Gillespie, the best exhibited both in design and quality.

No. 1596, lace work, by Miss E. Isaacs, is very beautiful.

A Certificate of Honorable Mention.

No. 1603, ladies' gloves, by J. R. Ashford, of Philadelphia, the best ever exhibited. A Certificate of honorable mention has been awarded by the judges of silk goods.

No. 1613, a case of very fine wrappers, by Henry V. Wright, of Philadelphia. A Certificate of Honorable Mention.

To Mrs. Rapp, of Philadelphia, for sundry specimens of the most elegant style of needlework, which have been universally admired.

A Certificate of Honorable Mention.

To Mrs. L. Dingee, of Philadelphia, teacher of shell and wax work, for No. 1585, a vase of very elegantly made, and tastefully arranged, artificial flowers, A Certificate of Honorable Mention.

To Mrs. S. A. Sendos, of Philadelphia, for No. 1514, a gentleman's shirt, of which the needle work is deemed to be finely executed.

A Certificate of Honorable Mention.

Nos. 1506 and 1508, cases of shirts, clothing, and stocks, by C. A. Walborn, of Philadelphia, are very well deserving of notice, but Mr. Walborn being a member of our Board of Managers, the regulations prevent our offering him a premium.

No. 1548, a bed quilt, deposited C. A. Hollowell, is very beautiful, both in design and execution.

No. 1600, ladies' gloves, by William Hawkins, are very fair goods of their kind, and a certificate of honorable mention has been awarded them by the judges of silk goods.

This committee notice with much approbation a fine display of gentlemen's shirts, and other clothing, by J. Hodges, of Philadelphia.

Having now given to the most meritorious articles displayed in the

fourteenth exhibition of the Franklin Institute, as extended a notice as was possible, within reasonable limits; having awarded to those who, in our opinions, after a careful examination, appeared to be *the most deserving*, fifty-nine SILVER MEDALS, and one hundred and fifty-four *Certificates of Honorable Mention*, in finally concluding this report, we should do great injustice to our feelings if we omitted to return our sincere thanks to the judges of the various departments, who have liberally devoted their time to an examination of the various articles, in such a minute and impartial manner, that we feel great confidence in the justice of the awards in the various industrial departments, in making which their opinions have given us the necessary basis for our guidance.

In taking leave of this respectable audience upon the present occasion, for another year, we do it in the buoyancy of a high hope that the skill of American artizans may improve in the year forward, as it undoubtedly has done during the one now terminated.

AMERICAN PATENTS.

List of American Patents which issued in April, 1844, with Remarks and Exemplifications. By CHARLES M. KELLER, *Examiner of Patents.*

1. For protecting the polished surface of *Metallic Reflectors, or Mirrors*, by means of glass; Alonzo Farrar, Boston, Massachusetts, April 4.

Claim.—“I claim the combination with a parabolic, or concave, reflector, or mirror, as ordinarily constructed, or the applying, or fitting, to the polished, or reflecting, surface of the same, of a concave surface of glass, or a concave glass lens, or meniscus, made perfectly symmetrical with said surface oppositely adapted to the same; all the exposed edges of the lens, or reflector, being hermetically, or otherwise, sealed, so as to be air-tight; the whole being constructed substantially as set forth, and for the purpose specified.”

2. For an improvement in the *Cooking Stove*; Roswell Bush, Rochester, Monroe county, New York, April 4.

The improvement consists in dividing the whole stove longitudinally, by means of vertical plates extending through the fire chest, or chamber, ovens, and flues, thus making two fire chambers, two ovens, and ten flues, where there were only half that number previous to the addition of said vertical division plates, and enabling the user to heat it in part only, or wholly, at pleasure. This stove has a diving flue between the fire chamber and oven, which flue extends under, up, back of, and over the oven; and at the upper front edge of the oven there are two dampers, one for each chamber, either to force the current of draught around the ovens, or permit it to pass directly

out of the pipe; and there are, of course, two corresponding flues at the back. For the purpose of causing the draught to pass entirely around the oven, there is a division plate in the flue space above the oven which extends from the back plate of the oven to within a short distance of the front of the oven; the draught after passing up the back flue goes under this horizontal division plate to the front of the oven, and then over the division plate to the chimney.

Claim.—“I do not claim the fire chamber and oven, and the flues at the end of, and beneath, the oven of a divided cook stove; but what I do claim as my invention in stoves thus divided, and which I desire to secure by letters patent, is the combination of the vertical division plates with the horizontal division plates, in the manner and for the purpose set forth.”

3. For an improvement in the machine for *Washing Clothes*; Lewis Woodward, Medford, Burlington county, New Jersey, April 4.

In this machine the clothes are to be washed by means of a fluted roller, and a brush below it, which is attached and borne up to the roller by weighted levers.

Claim.—“What I claim as my invention, is combining a revolving fluted roller with an adjustable flexible brush, in the manner and for the purpose described.”

4. For an improvement in the *Saw Gin*, for ginning cotton; Eleazer Carver, Bridgewater, Plymouth county, Mass., April 4.

We are informed by the patentee, that the “improvement is designed to protect and hold the fibres of cotton while on the teeth of the saws, in such a manner as to enable the brush to operate more perfectly in taking the cotton off from the teeth of the saws in loose and uniform quantities. In the operation of the common gin, as the saw cylinder revolves, the teeth of the saws catch and draw the fibres of cotton away from the seeds through the grate; after which these fibres are swept, or blown, off from the teeth by a rapidly revolving brush, and thrown out at the back side of the gin. These fibres, however, as they come through the grate aforesaid, are bent backwards around the teeth of the saws, so that the loading of every tooth, to some extent, becomes intermixed and connected with the loading of each succeeding tooth, and they thus adhere together, insomuch that the brush is apt to take off, or draw off, from the saws more than it actually comes in contact with, and more than it should do in order to separate and straighten the fibres properly. This difficulty is also increased by the wind which is produced by the brush, which frequently loosens the cotton on the teeth of the saws before they have revolved far enough to come within the proper action of the brush, so that in the common gin the brush takes the cotton through the machine in masses too large, and in a doubled, connected, and improper state.” These evils are obviated, and the fibres straightened in the act of brushing, by means of guards, which are attached to the back of the ribs, and extend down some distance below the line

where the saws pass out of the ribs; these hold the fibres whilst the brush acts upon them.

Claim.—“I claim as my invention, the guard for protecting and holding the fibres of cotton, while on the teeth of the saws, for the purpose herein set forth, and applied substantially in the manner herein described.”

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5. For an apparatus for *Fitting Ladies' Dresses*, denominated the “trimeasure rule;” Samuel S. Richardson, Baldwin, Cumberland county, Maine, April 4.

“The apparatus consists of a measure and corresponding diagram; the measure is made of oiled linen tape, or other fabric, forty-five inches in length, and is adapted to three separate admeasurements.”

Claim.—“What I claim, is the mode herein described, of fitting ladies' dresses by the combined use of the triple-measure and diagram, both graduated in the manner described.”

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6. For an improvement in the *Truss Frames of Bridges*, applicable to other purposes; Thomas W. Pratt, Norwich, Connecticut, and Caleb Pratt, Boston, Massachusetts, April 4.

In each panel, or between every two posts, there are two diagonal tension braces, or screw rods, crossing, each extending from the bottom of one post to the top of the other; these rods pass through straining blocks at top and bottom, against which the nuts, on the tension rods, act.

Claim.—“We claim the above described method of constructing a truss, that is to say, the combination of two diagonal tension braces and straining blocks in each panel of the truss frame of a bridge, by means of which the camber may be regulated so as to increase, or diminish, it, either in whole, or in sectional parts, of the bridge, the whole being constructed and operating substantially as set forth.”

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7. For improvements in *Mills for crushing and grinding Corn*; Samuel L. Herr, Mexico, Juniata county, Penna., April 4.

The mill in question consists of two vertical disk grinders, one permanent, and the other a runner; the outer portion of their faces is formed in the usual manner of grinders, and the inner portion provided with cutters for slicing the cobs, and sharp pointed teeth for reducing the slices preparatory to the grinding. The permanent disk has a hole through it, and a hopper to introduce the corn and cobs to the parts provided with cutters and teeth; there being one knife at the edge of the opening, and two knives on the runner.

Claim.—“I do not claim attaching knives to a runner, as that has already been done, neither do I claim forming the disk with teeth and ribs, which has been before effected, but what I do claim as my invention, and which I desire to secure by letters patent, is the combination of the teeth and ridges with the knives, in the manner described; the whole being constructed and arranged for the purpose set forth.”

8. For an improvement in the *Cotton Seed Planter*; Dierck Brewer, Petersburg, Lincoln county, Tennessee, April 4.

To the bottom of a hopper, or box, mounted on wheels, there is an inclined shoe, which is shaken by means of an arm extending from the side of it, and acted upon by teeth on the face of one of the wheels; passing through this hopper, and just above the shoe, there is a roller, or axle, armed with spikes, to distribute the seeds, and cause them to be discharged from the shoe into the furrow, made by a tooth, or coulter, at the forward part, and covered by a drag at the back of the machine. The roller, or axle, is provided with a pinion at one end, which takes into teeth on the face of one of the wheels.

Claim.—“What I claim as my invention, is the combination of the axle and vibrating shoe with the seeding machine; constructed and arranged in the manner and for the purpose described.”

9. For an improvement in *Cooking Stoves*; Abner Leland, Milton, Northumberland county, Pennsylvania, April 4.

In this stove the fire chamber is above the oven, and the flue spaces along the sides, bottom, and back; the side plates of the oven extending up near to the top plate of the stove. There is a space between the bottom of the grate and the top plate of the oven, and as the grate is much smaller than the oven, there is a plate that extends from the back of the grate to the back of the stove, which plate and grate are to be removed, when wood is to be substituted for coal. The draught passes from the fire chamber over the side plates of the oven, (which are, as before stated, extended nearly up to the top plate of the stove,) passes down, and enters the bottom flue through two openings in the side plates near the front of the stove, and from the bottom flue it passes into the back flue, and out into the chimney. The back part of the top plate of the oven is cut out and provided with a grate, which leads, by means of inclined tubes, into the back flue, for the discharge of ashes, which is drawn out through a door that opens into the bottom flue.

Claim.—“What I claim as my invention, is the open space between the fire chamber and oven, and, in combination therewith, the ash tubes with their grate for discharging the ashes.”

10. For an improvement in the mode of *Connecting a Carriage Body with the Perch*; George Nichols, Trumbull, Fairfield county, Connecticut, April 10.

This is for an improvement on a patent previously granted to Stephen Tomlinson, on the 16th of May, 1842, which has not yet been noticed in this Journal.

Claim.—“I do not claim connecting the body of a carriage with the perch, by means of longitudinal springs, as that has before been done, the springs being firmly connected at each end; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the spring stay braces with the perch, by means of

bolts passing through slots in the ends of said braces, in the manner and for the purpose described."

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11. For improvements in machinery for *Pecking, or Dressing, Stone*; Hammond Ward, Charlestown, Worcester county, Massachusetts, April 10.

The block of stone to be pecked and dressed is placed upon a carriage, which passes it, by a slow motion, under a series of pecking and dressing chisels. These chisels slide in a frame inclined to the plane of the carriage, that they may act on the stone obliquely, instead of vertically, and, for the purpose of changing this inclination, one end of this frame is jointed to the main frame of the machine, and the other may be elevated and depressed at pleasure. The chisels are held up by springs, and forced against the face of the stone by hammers actuated by tappets on two shafts, one at each end of the frame. The first and second rows of these chisels are pointed, for the purpose of pecking, and the others are flat, for dressing the surface. For squaring, or forming, the edges of the stone, there is a chisel on each side, with the lower edge at right angles with the side, and operated in the same manner as the peckers and dressers; these break off the stone, and form the edge, so that when the block is turned over to have the other faces dressed, the sharp corners shall not be broken off.

Claim.—"I claim the manner by which I am enabled to vary, or alter, the inclination of the cutting chisels, with respect to the plane, or face, of the stone to be dressed, viz., by sustaining, or arranging, the stocks, or spring holders, of the chisels in a movable frame, which shall turn on centres, or bearings, disposed at one end thereof, or any other suitable part of the machine; also the combination with the series of cutters for dressing the top surface of the square, or blunt, edge cutter, or cutters, for the purpose of forming the square corner, or edge, of the stone, as set forth."

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12. For an improvement in the *Pump*; T. Jefferson Wolfe, Baltimore, Maryland, April 10.

The pump chamber instead of being cylindrical, as generally made, is in the general form of a hand bellows—the discharge valve being in the top, the discharge pipe extending up from it, and the admission valve in the bottom, which is hinged to the top at one end, and to the connecting rod at the other.

Claim.—"What I claim as my invention, is the mode in which I have constructed my forcing pump; that is to say, by placing the forcing chamber, constructed as described, under the water line, the valves and piston, or connecting rod, being arranged and operating substantially as set forth. I also claim, in combination with the above, placing the piston, or connecting rod, and the discharging passage for the water, in separate bores of the pump log."

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13. For a *Current Water Power*, to be substituted for water-wheels in mills; John Carnegy, Tulley, Lewis county, Missouri, April 10

The patentee says,—“My apparatus is of that kind in which a number of buckets are affixed to two, or more, endless chains that pass around suitable drums, to which said chains are geared by teeth on said drums, the teeth taking into the links of the chains. The buckets are to be attached to the chains by hinge joints, so that they may fall over and lie flat upon the chain, as they are carried back on the upper side of it. The chains and buckets, with their appendages, are to be secured in a proper frame, constituting a part of a hollow trunk, sustained by two floats, or bnoys, in such manner as that the whole apparatus shall rise and fall with the rise and fall of the current in which it is placed.” Chain paddles have long since been attempted, but set aside because nearly the whole force of the current is expended on one paddle only, which cuts off the action of the current from the others: with the view to obviate this defect, the patentee describes the application of gates to each side and bottom of the hollow trunk, each succeeding gate being extended out farther than the preceding, to catch the current, and conduct it on to the paddles.

Claim.—“What I claim as new, is the employment of a series of buckets which are connected by hinge joints to two, or more, endless chains, in the manner set forth; the shafts of which buckets are furnished with friction wheels, or rollers, that run between ways below and above them, and have stop pieces that extend back, so as to come into contact with a link of the chain in the immediate vicinity of the next succeeding bucket, in the manner and for the purpose made known, which endless chains of buckets, so arranged, I intend to combine with a floating trunk furnished with wing gates, and otherwise constructed as described.”

14. For improvements in *Clocks*; Frederick Kesselmeier, Wooster, Wayne county, Ohio, April 10.

“The nature of this invention consists in combining with a clock of common construction, a balance pendulum, or regulator, and an improvement in the striking part; any escapement may be used, but preference is given, by the patentee, to the dead beat escapement in any of its modifications.

Claim.—“What I claim as my invention, and desire to secure by letters patent, is the balance pendulum, or regulator, constructed in the manner specified; I also claim the cam wheel for moving the hammer, combined with the striking parts of the clock.”

15. For an improvement in *Smut Machines*; Samuel Scammon, and Rufus Nason, Waterville, Kennebec county, Maine, April 10.

Claim.—“What we claim is the method of creating an upward current of air, by fans placed at the bottom of the inner cylinder, and admitting air at the top, instead of the bottom, of the cylinder, as is now used, by which we obviate the difficulty explained. We disclaim the invention of the machine, and all parts of it, except the fans, and the method of introducing the air, in the manner and for the purpose specified.”

The object of introducing the air at the top, instead of the bottom, is to avoid forcing in air in which is suspended the impurities that have been discharged from the grain.

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16. For improvements in the *Cooking Range*; Julius Fink, Philadelphia, Pennsylvania, April 10.

The two ends and the front of this range constitute five sides of an octagon; the middle division forming the front of the fire chamber, and the division next to it on each side, the front of an oven—the one on the right being designated, in the claim, by the letter B, and the other by the letter C. The fire chamber, which is triangular, is formed by one side of each of the ovens, the one on the right being deeper than the other, and extending to about the middle of its width. The draught from the fire chamber is divided; one portion passes over the oven C, down a diving flue G, at the opposite side, under and up through a flue H, between the back of the oven C, and that portion of the side of oven B, which extends beyond the fire chamber, and then escapes into the chimney through a flue I. The other portion of the draught passes over the oven B, down a diving flue G', at the side opposite the fire chamber, under, and up a flue space I. There is a tube, or trunk, open at both ends, which passes through the bottom flue space of oven B, to form a communication between the ash pit, and a flue, K, which communicates with an independent flue, K', to carry off the fumes, or vapor, arising from the ash pit.

Claim.—“What I claim as new, is the manner in which I have combined and arranged the fire chamber, and the ovens B and C, the former being triangular in its horizontal section, and having one of its backs in contact with one side of the oven B, and the other in contact with one side of the oven C; by which arrangement I am enabled, not only to heat said ovens directly, but also to give to one of them a much greater depth than can be attained in a range of the same length, if made in the usual form. I claim, in combination with the foregoing, the particular manner in which I have arranged the flues of the respective ovens; the draught of that marked C, after passing down the descending flue G, ascending in the flue H, thereby aiding in heating the rear of the oven B, and finally escaping into the flue space I; the flue of the oven B, also descending through the flue G', on one side of it, and escaping into the space J, through an opening herein designated by the letter C". I claim the arranging of the tube, or hollow trunk, for the conveyance of a draught of air from the ash pit through the flue space under the oven B, and into that designated by the letter K, to be conveyed off by the independent flue K.'

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17. For a composition of matter called *Garrison's Compound Balsam of Liverwort Candy*; Henry and George Garrison, Newburg, Orange county, New York, April 10.

This is for making a candy, by mixing the following ingredients, viz:—“Sugar, 108 parts of extract; sarsaparilla, 5 do.; liverwort, 4

do.; thoroughwort, 5 do.; horehound, 8 do.; olive oil, 1." We are informed in the specification, that this compound is intended as a specific for "all pulmonary affections leading to consumption."

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18. For an improvement in *Cooking Stoves*; Frederick Kesselmeier, Wooster, Wayne county, Ohio, April 13.

We have here a stove of a quadrangular form, with the oven by the side of the fire chamber, the two being separated by a partition plate; and at the upper back corner this partition is pierced to admit the draught to pass down a flue at the back of the oven, from which it passes to a flue at the side, and then through a hole in the plate, which forms the side of the oven, to a flue between the back plate of the oven, and the back flue first described, and thence along the top flue to the funnel, or pipe, at the top. The top plate of the stove is provided with boiler holes, having flanches that extend up, and are united to corresponding holes in the top plate of a jacket, or case, which surrounds the whole of the stove, leaving a hot air chamber all around the stove for heating air to be conducted into upper apartments, in a space between the smoke pipe and a jacket surrounding it.

Claim.—"What I claim as my invention, is covering the stove with a case in the manner described, so that the flanches around the boiler holes shall connect with said case for the purpose specified. I also claim the combination and arrangement of flues herein fully described, by which a more equal distribution of heat is effected."

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19. For an improvement in *Whipple-trees*, for disengaging horses from carriages; James S. Shuell, Shiremantown, Cumberland county, Pennsylvania, April 13.

The nature of this improvement consists in connecting the spring bolts, now used for connecting the traces with the whipple-tree, with arms attached to an upright revolving shaft, in the middle of the whipple-tree, by turning which the bolts are drawn back, and the horses liberated. This is effected by a cord attached to an arm on the said shaft, which extends to the driver's seat.

Claim.—"What I claim as my invention, is the combination of the shaft and arms with the spring bolts, constructed and arranged in the manner substantially as herein described, and for the purpose set forth."

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20. For an improvement in the *Cupping Apparatus*; Robert J. Dodd, Philadelphia, Penna., April 13.

The plate with the cupping lancets is screwed to the stem of an air-pump, and the body of the air-pump slides in a stuffing box in the end of a glass cup provided with a bulb at the side, and a cap at the end opposite the stuffing box, formed in the usual manner, to suit the part to be cupped. By this arrangement it will be seen that the lancets are operated by sliding the body of the air-pump, which slides

in the stuffing box, and then the air exhausted to draw the blood by working the piston of the air-pump.

For operating on parts which cannot be reached by the common cupping instrument, a glass tube, of any form required to reach the part, is screwed on to the end of the cup, and a flexible metal tube, with a small triangular lancet on the end, screwed to the stem of the air-pump. In this way the operator can scarify the part, and exhaust without changing instruments.

Claim.—“What I claim as new and original, is the above described method of combining an exhausting syringe with a cupping apparatus, such as is represented, or any other substantially the same in principle, by means of the cup and stuffing box described. I also claim, in combination with the above, the manner in which I operate the lancets for the various purposes above specified, the whole being constructed and operating in the manner set forth.”

21. For an improvement in the *Plough for ditching*; James Herbert, La Grange county, Indiana, April 13.

The share of the plough is made of sufficient breadth for the bottom of the intended ditch, and the mould-board of sufficient capacity to carry up the earth, and discharge it on the side of the ditch. Oblique cutters, made in sections, extend up from the share to the beam, for forming the sides of the ditch; and for the purpose of cutting the sward, rots, &c., there are sharp edged wheels, or disks, attached to the beam, or frame, forward of the oblique cutters, and in the same range with them.

Claim.—What I claim as my invention, is the employment of rotating cutter-wheels attached to the forward end of the frame in the machine referred to, for cutting the earth and sward as described, in combination with the said plough and side cutters; and the side cutters consisting of two, or more, parts each, as described, and connected together for the purpose and in the manner described.”

22. For an improvement in the manner of *Forming Rails for Rail-Roads*; James M. Bay, Harrisburg, Penna., April 13.

These rails are formed of quadrangular bars, cast on to small wrought-iron bars, and at the ends they are formed with wings, brackets, or flanches, by which they are bolted to the stringers, as a substitute for chairs; and for the purpose of retaining all the rails in line, at one end the rail projects beyond its wings, or flanches, and is received between the wings, or flanches, of the next section, which, for that purpose, project beyond it.

Claim.—“What I claim as new, is the particular manner of forming the bars at their ends, which is such, that the end of one bar, in its whole size, shall be received between the wings, or brackets, which form the chair, or that part which forms the next contiguous bar, is attached to the string piece, as described; by which improvement on a cast-iron rail, that has a wrought-iron rod inserted in it, I have

rendered such bars, when resting on string pieces, perfectly safe, and am enabled to substitute a cheap for a costly rail.”

The rod of wrought-iron within the cast-iron rail is not claimed.

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23. For an improvement in the *Corn Sheller*; William McCall, Talladega, Alabama, April 13.

The patentee calls this the “fistular corn sheller,” because it consists of a hollow cylinder with teeth, on the inner periphery, towards one end, if single acting, and at both ends, if double acting. This hollow cylinder is mounted on a frame, and has a pulley, or cog-wheel, on the middle of its length, by which it is rotated. The attendant presents an ear to the action of the teeth, and after the corn has been stripped from one half, it is drawn out, and the other end presented. The corn is discharged through a hole in the cylinder into a box which surrounds it.

Claim.—“What I claim as my invention, is shelling corn with spurs, or teeth, on the end of a fistular cylinder, which admits the cob to pass into the fistular, and as the small end of the cob almost invariably contains rotten corn, which is permitted to pass between the spurs, or teeth, on the fistular cylinder, without touching, it thus remains on the cob, and is separated from the fine corn. I likewise claim the originality of constructing a double sheller, that is, one at each end of the fistular cylinder.”

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24. For an improvement in machinery for *Splitting Strips, or Pieces, of Leather, for the use of Harness*; Alpha Richardson, Boston, Massachusetts, April 17.

This machine, like many of those in general use, consists of a feed roller, a gauge roller above it, and a knife, against which the leather to be split is forced by the rollers—the upper roller gauging the required thickness of the leather. We are informed by the patentee, that in the machines which have heretofore been used for the purpose above specified, the cutting edge of the knife has always been made of a wedge shape, that is, with a bevel both on the upper and under side, and the gauge and feed rollers have always been arranged one above the other, with their axis in the same vertical plane, the edge of the knife being directed to the bite of the rollers on their line of contact, when brought close together. In these machines it has been found impossible to adjust the edge of the knife in such a manner as to cut a piece of leather evenly, so as to have the cut of an uniform thickness, and, in fact, the strip of leather runs, or passes, down on the underside of the knife without being operated upon by the same. The reason for this is that the beveled faces of the knife come in contact with the surfaces of the rollers before the edges can be brought sufficiently near to the bite of the same, to prevent the effects aforesaid. This improvement will effectually prevent the bad results above set forth, and consists in forming a knife with its under side only beveled, and in arranging the bilge of the under side of the upper, or gauge, roller directly over the edge of the knife, so as to

guide the strip of leather accurately to the same; while the bilge of the upper side of the lower roller is placed at a little distance from the edge of the knife, so that the said edge may be brought very near to the surface of the said roller, and prevent the leather from passing down without being split."

Such are the views and the device set forth in the patent under consideration.

Claim.—"I claim the arrangement before specified of the gauge and feed rollers of a leather splitting machine, so that the bilge of the lower side, or the axis of the former shall be directly over, or in the same vertical plane with, the edge of the knife, while the axis of the latter is a little distance out of said vertical plane, and its upper bilge is a little above the level of the edge of the knife, for the purposes recited."

25. For an improvement in *Wrought-Iron Ploughs*; John Thompson, Ripley, Brown county, Ohio, April 17.

The patentee says,—"The nature of my invention consists in turning the sheath (standard) of the plough outward along the front edge of the mould board, where it joins the share, so as to strengthen it at that point, and prepare a solid seat for the share."

Claim.—"What I claim as my invention, is constructing the sheath so as to turn outward along the edge of the mould board, where it joins the share, all the bolts by which the mould board and share are connected, being put through said sheath in the manner and for the purpose specified."

26. For an improvement in *Locks for safes, vaults, &c.*; Marcus R. Stephenson, and Oliver Edwards, Boston, Mass., April 17.

This is for an improvement in the permutation, or combination, lock, and consists of a stud projecting from a plate which slides in a groove in the bolt, and at right angles to its length; this stud passes through slots in the permutation tumblers, or sliding plates, and hence the bolt cannot be moved unless the stud corresponds with the slots in all the tumblers. There is an extra lever on the key, which acts on the plate of the stud to place it in the proper position, as well as the permutation tumblers. It will be seen that this will render it much more difficult to open the lock than when the stud is permanently attached to the bolt, for then, by applying pressure to the bolt, a skilful pick-lock can ascertain when the opening in each tumbler is in line with the stud; but in this the very application of pressure to the bolt prevents the stud from moving.

Claim.—"Having thus explained our improvement, we shall claim arranging the stud so as to slide freely up and down, (the same being fixed upon a sliding plate adapted to a groove, and combined with the main bolt,) and be operated by the key, as set forth, or by any other means substantially similar, and the same being for the purpose specified."

27. For a composition of *Sealing Wax and Phosphorus*; John Fatman, Philadelphia, Pennsylvania, April 17.

The sealing wax is made into small sticks of about two inches in length, and one-eighth of an inch in diameter, one end of which is coated with any of the known mixtures of which friction matches are made—to avoid the necessity of a candle in using sealing wax.

Claim.—“What I claim as my invention, is the combination of phosphorus with sealing wax, in the manner and for the purpose described, not confining myself to any particular size, shape, or color, of the sticks. I do not claim the manufacture of sealing wax, nor the composition of igniting matter.”

28. For an improved method of indicating and regulating *Changes of Temperature*, called the “*Thermostat*,” Samuel D. Tillman, Seneca Falls, Seneca county, New York, April 17.

“The nature of this invention consists in the construction of a machine which is moved by the expansion and contraction of a metallic ring upon the application of caloric, and by means of an index, indicates the degree of the caloric by which it is effected; also in the several modes of applying it to dampers, so as to regulate the radiation of caloric from any stove, dumb-stove, pipe, or other structure, in which caloric is generated, or contained; also applying it to ventilators and registers, for the regulation of the temperature of a room.”

Claim.—“What I claim as new, are the modes herein described of regulating and indicating changes of temperature by means of a metallic ring; also by means of a ring of zinc inclosing a broken ring of iron, or steel; said ring of steel being attached by one of its ends to the zinc ring, and free to move through its length, its free end operating upon an index by means of a rack and pinion, or other similar device. I also claim the combination of the above arrangement, which I denominate a thermostat, with a register plate, or valve, for regulating the heat of a stove, or for similar purposes, such as the ventilation of rooms, &c., as described. I may use for the above purpose, other metals whose expansive properties are well known.”

29. For an improvement in *Locks, for vaults, safes, &c.*; Marcus R. Stephenson, and Oliver Edwards, Boston, Mass., April 17.

For an explanation of the purpose of this improvement, the reader is referred to the notice of No. 26, of the patents granted the same date as this, the two improvements being for different modes of effecting the same end.

The main bolt has an elongated slot which works on a permanent stud projecting from the lock plate, and on the rear side of the bolt there is a bent lever, or plate, which turns on a pin projecting from the bolt, so that the two move together. This bent lever, or plate, has a slot cut in it, to admit of its sliding with the bolt on the stud before mentioned, and one edge of this slot is continued out to form

an arm, with a notch on the end, and to this bent lever, or plate, and at right angles, or nearly so, to the arm just described, the stud, which slides in the permutation, or combination, tumblers, is attached, so that any pressure applied to the bolt, before the key has adjusted the tumblers, for the free passage of this stud, causes it to strike against the tumblers, which throws up the notched arm in front of the permanent stud, and thus the bolt is prevented from moving backwards.

Claim.—“We claim the combination of appendages to the main bolt, lock case, and stud, (or bent lever,) the said appendages being a bent lever, or plate, having an arm extending from it in the manner described, and the fixed stud of the lock case; the usual stud being made to extend from the bent lever, or plate, and the said plate being made movable upon a fulcrum applied to the main bolt, and the whole being otherwise adapted to the sliding plate, and other parts, and operating substantially in the manner and for the purpose specified.”

30. For an improved mode of *Cutting, Fitting, and Rigging Sails to square-rigged vessels*; Warren C. Choate, Washington, District of Columbia, April 17.

The sails are cut in two pieces, the starboard and larboard halves; the inner and upper edges are bent with rings, those of the upper edge to run on an iron rod called a jackyard, attached at each end to the yard arm, and those on the inner edge running on a jackstay which extends from the jackyard down. The sails are unfurled and furled by means of out and in haulers.

Claim.—“What I claim as my invention, is constructing the sails of square rigged vessels in two separate parts, the starboard and larboard halves, being entirely separate from each other. I also claim the combination of the jackyards and rings, and out and in haulers, with the yards of vessels constructed and arranged in the manner and for the purpose set forth. I also claim, in combination with the above, what I denominate a jackstay, for the inner back of the sail to traverse on, as described.”

31. For an *Æolian attachment for Piano Fortes*; Obed M. Coleman, Philadelphia, Penna., April 17.

“The nature of this improvement consists in combining with the piano, as ordinarily constructed, a series of reeds, in such a way as that each key shall act upon a reed, by opening a wind passage thereto, at the same time the hammer strikes the strings; and also in the manner in which said reeds are combined therewith.”

Claim.—“What I claim as my invention, and desire to secure by letters patent, is, first, the combination of the metallic reeds with the piano forte, or other stringed instrument, for the purpose herein described; secondly, I claim the method of combining the bellows with the piano forte, by placing the feeder and riser side by side, so as to lay compactly under the bottom of the piano forte, without disfiguring its exterior; thirdly, I claim combining the action of the

piano forte with the pallets of the reeds, by connecting them by means of the strickdowns and regulating wires, constructed and arranged substantially in the manner and for the purpose described."

32. For an improvement in *Washing Machines*; William Newbrough, Wooster, Wayne county, Ohio, April 17.

This is for a modification of a washing machine patented by James B. Coffin, on the 2d of February, 1844, and noticed at page 232, to which the reader is referred, and consists in forcing the rollers against the clothes attached to the vibrating frame, between the two sets, by means of two cords at each end, which are fastened together at the bottom of the box, or tub, made to embrace the gudgeons of the rollers, which slide in horizontal, instead of inclined, grooves, and then passes around a small roller at right angles to the rubbing rollers, and from thence over the end of an arm extending from the said roller to a weight.

Claim.—"I wish it understood that I do not claim the invention of the combined series of rollers, but what I do claim as my invention, and desire to secure by letters patent, is the employment of a chain, embracing the journals of rollers, as above set forth, in combination with the rollers and weight, constructed and arranged substantially as described, by which the rollers are pressed towards each other."

33. For an improvement in the apparatus for *Inking the Form in Printing Presses*; Richard M. Hoe, New York City, April 17.

Claim.—"I do hereby declare that I do not claim the forming of a roller hollow, for the purpose of passing steam, or heated air, through it, in order to elevate its temperature, this having been frequently done, and for various purposes; but what I do claim as new, and as constituting a real improvement in the inking apparatus of a printing press, is the combining of a hollow roller, to be heated by steam, or otherwise, with the fountain, or ink trough, of such inking apparatus, by means of which improvement a quality of ink may be used which could not otherwise be employed, and a better kind of work performed than when such roller is allowed to remain at the ordinary temperature of the atmosphere."

34. For an improvement in the *Cylinder Printing Press*; Richard M. Hoe, New York City, April 17.

"In the cylinder printing press, as ordinarily constructed, there occurs a slur, or slip, when the cylinder arrives at the head and the foot lines of the page in the forms, occasioned by a slight sinking of the cylinder in passing those points, the consequence of which is that the types, or stereotype plates, are subjected to a more rapid wear in those parts than elsewhere. The object of this improvement is the correction of this evil. For this purpose there is placed a bearer of iron, or of steel, on each side of the bed of the press, upon which bearers the cylinder is to roll, and to be sustained during the whole

time the blanket is not bearing on the type. These bearers may be about an inch and a half in width; and they are to be of a thickness equal to the length of the type, or the height of a stereotype. I also make an enlargement on each end of the cylinder around that part of it which is to rest on the bearers. This enlargement may be in width the same with that of the bearers, and the parts composing it are to rise above the general surface of the cylinder, to the thickness of the blanket which is to cover that portion of the cylinder which passes upon the form, by which means the two surfaces will work exactly together, and no slur can take place."

Claim.—"What I claim therein as new, is the employment of adjustable bearers on the sides of the bed, in combination with the enlargement of the cylinder, in the manner and for the purpose set forth; and it is to be understood that I do not intend to limit myself to the mode of adjusting the bearers by forming them of two wedge-like bars, as herein described, as such adjustment may be effected in other ways; but I have mentioned this mode as that which I have deemed the most simple, and the best."

35. For an improvement in the *Steam Valve for Steam Engines*; Sprague Barber, New York City, April 20.

"The object of this improvement is to control, or regulate, more perfectly, the quantity of steam which is allowed to pass into the cylinder while the engine is passing the centres, and thereby relieve it of much unnecessary friction, and from the unpleasant, injurious, destructive shock, or jar, which is usual, especially on board of steamboats." To accomplish this object there is a ring which projects from the end of the conical portion of the valve, and which passes into the aperture of the valve seat, leaving a space between the inner periphery of the valve seat, and the ring on the valve of about one-sixteenth of an inch, through which the steam passes, until the valve is lifted sufficiently high to withdraw the check ring from the valve seat.

Claim.—"What I claim as my invention, is the check ring used in connection with the steam valve substantially as described."

36. For an improvement in machinery for *Spinning, or Making, Roving, &c.*; Phineas Stevens, Nashua, New Hampshire, April 20.

On the shoulder of the dead spindle, and between it and the bottom of the bobbin, there is a washer with two arms extending out far enough to be struck and carried around by the arms, or wings, of the flyer.

This improvement is introduced by the patentee as a substitute for, and as being equivalent to, the live spindle for the spinning of fine yarn, and for making roving.

Claim.—"I claim the metallic washer, arranged upon the spindle, and having arms, or other contrivances of like character, for the purpose of causing the same to be revolved by the flyer; the whole being operated substantially in the manner, and for the purpose described."

37. For an improvement in the *Bee-House*; George R. West, Fairfield, Huron county, Ohio, April 20.

The hives are made with a double inclined bottom, and an opening at the junction of the two inclined pieces forming the bottom, for the discharge of filth into a drawer below. In the house the hives are arranged side by side with a space between them for the entrance of the bees, which space is divided into two passages by a partition, so that the bees from different hives cannot encounter each other.

Claim.—“What I claim as my invention, is the arrangement of the hives with the double inclined bottoms, in combination with the filth drawers extending under both hives—said hives being separated before their entrance by division plates. I do not claim the double inclined bottom, nor a filth drawer under the same, but I claim the above combination.”

38. For an improvement in the *Furnaces of Steam Boilers*; Peter Robinson, Waterloo, Seneca county, New York, April 20.

This is for an alleged improvement in the mode of introducing either cold, or heated, atmospheric air into the flues of steam boiler furnaces, with the view to the better combustion of the combustible gases evolved in the furnace. A pipe is situated at the back of the apparatus, and opening into the end of the return flue; it is provided with a register plate to regulate the introduction of the air, which meets the gases as they turn to enter the return flue, and in this way the air and gases are not only commingled, which is important to combustion, but the draught, in the opinion of the patentee, is greatly increased.

Claim.—“What I claim as new, is the introducing of atmospheric air either at its ordinary temperature, or after it has been duly heated, into the end of the flues of such boilers, where gaseous matter enters, through a tube furnished with a register, or other means of regulating the quantity admitted, said tube being situated, arranged, and operating substantially in the manner set forth.”

39. For an improvement in *Churns*; Harness Bently, Ballston, Saratoga county, New York, April 20.

The barrel of this churn is rotated on a spindle at the bottom, by means of a band which passes around the barrel, and a drum, or pulley, on the shaft of one of a train of cog-wheels actuated by a weight, in the manner of a clock; and the dasher is jointed to one end of a lever, the other end of which is in connection with a crank pin on a fly-wheel.

Claim.—“I wish it to be understood that I do not claim driving the dasher of a churn by weights, as that has been before effected, although in a manner somewhat different from mine, but what I claim as my invention, and desire to secure by letters patent, is the employment of a revolving churn, and reciprocating dasher, in combination with the driving power, as described.”

40. For an improved mode of *Calking the seams of ships, cellars,* and for other similar purposes; William Bennet, New York City, April 20.

"The nature of my invention," says the patentee, "consists in filling the seams, between the planks of which the sides and bottoms of ships and cellars are covered, with wooden wedges, so formed of a suitable width, thickness, and taper, as that every alternate wedge being tapered towards the point edgewise, and sidewise, and placed between intermediate wedges having their taper edgewise towards the head, but tapering sidewise, like the former, towards the point, are placed along in the seam at such distances apart, that, when driven, shall wedge each other edgewise, and against the plank sidewise simultaneously, and thus render the seam water-tight.

Claim.—"What I claim as new, is the particular manner in which I combine the two kinds of wedges set forth, with the edges of the two contiguous planks forming a seam, by which the wedges so formed, as described, do wedge themselves water-tight at their edges simultaneously with the filling of the seam water-tight, by wedging at their sides, also between the plank forming the sides and bottoms of ships, cellars, and analogous purposes."

41. For an improvement in the machine for *cleaning Grain, and separating it from straw, &c., after thrashing*; Charles W. Catheart, New Durham, Laport county, Indiana, April 25.

The straw, grain, chaff, &c., is to be discharged from a thrashing machine, or otherwise thrown on to an inclined screen, vibrated by means of bell cranks at each end. The straw is drawn up on this inclined screen by means of an endless belt of rakes; and during this operation the grain passes through the screen on to an endless belt of elevators, which carries it up and discharges it into a fan to separate the chaff. The straw is discharged at the top from the screen on to a short inclined shaking frame made of slats, so that any grain that may have been carried up may pass through this slat work, and fall on to an inclined board attached to, and moving with, the shaking frame, by which it is conducted to the fan.

Claim.—"I do not claim the movable screen, or a movable elevator, but what I do claim as my invention, is the combination of the movable screen, revolving rake above, and endless apron elevator below, in the manner substantially as described. I also claim the shaking frame, in combination with the above, constructed and arranged as set forth."

42. For an improvement in *Suspender Buckles and Fastenings*; Henry Dubosq, Philadelphia, Penna., April 25.

Instead of making the loop, through which the double strap of a suspender passes, a part of the buckle is made separate with a stem having a "clasp, or work piece," which fits in a slotted eye in a stem projecting from the buckle, to give free play. The "clasp, or

hook," is a button with a shank, and the slot, in the projecting piece of the buckle, is enlarged at the top, to admit the head of the hook, or clasp, which, when passed in, and drawn down, holds the two together.

Claim.—"I do not claim the mode described of fastening the buckle and eye, nor do I claim the use of this mode of fastening in clasps, when freedom of motion is not desired; but what I do claim as my invention, is the combination of a suspender buckle furnished with a projecting piece, or eye, with the clasp, or hook piece, and a double strap. I limit myself to the above combination, whereby I get freedom of motion about a pivot, and great facility for fastening and unfastening."

43. For an improvement in the mode of securing *Tin, and other Plates, in making metal roofs*; Peter Naylor, New York City, April 25.

Claim.—"What I claim as new, and desire to secure by letters patent, is the attaching of plates by passing their edges between the joinings of double cleats, or strips, of wood, forming ridges from the eaves to the top of the roof, and soldering said plates to strips of metal confined down by said cleats, as described."

44. For an improvement in the *Hay Press*; Charles F. Paine, Winslow, Kennebec county, Maine, April 25.

The bed plate of this press is at top, and the platen, or follower, below, so that it works upwards in pressing. Pressure is given by means of two toggle joint, or progressive, levers, the follower being connected to them by rods that extend up from the bottom of the follower to the upper arms of the levers; and the improvement for which the patent is granted, consists in connecting these rods with the bottom of the platen, or follower, by means of joint links, so that after a bale has been pressed, and the follower secured, and the tension of the levers removed from the rods, they will descend, and in doing so the jointed links which form their connection will remove them from the sides of the bale, and leave it free to be removed from the press.

Claim.—"I claim connecting the feet of the platen rods with the platen, or follower, by means of links, or other contrivances of similar character, the object of the said links being to permit the lower ends of the rods to be moved laterally from the ends of the bale, as set forth."

45. For an improvement in *Seed Drills, or Planters*; Loea Pratt, Amherst, Hillsborough county, New Hampshire, April 25.

From the bottom of a hopper which contains the seeds, there is a dropping tube, the aperture to which is governed by a sliding plate. This sliding plate is jointed by one end to the frame, and the other is vibrated by a series of cams on the face of the wheel which carries

the machine—a spring being employed to keep the said plate against the face of the cams. On the other face of this wheel there is another set of cams set further apart, and the sliding, or vibrating, plate is so arranged that it can be shifted from one side to the other whenever it is desired to drop the seeds nearer together, or farther apart. The rim of the wheel is triangular and sharp, for the purpose expressed in the following—

Claim.—“I claim the triangular projection, or rim, applied to the periphery of the wheel, for the purpose of opening the furrow, and thereby dispensing with a furrow plough, such as is generally used in drilling machines; also arranging upon the sides of the wheel, opposite to that on which the first series of cams is placed, and in combination therewith, a second series, the cams of which are placed at greater, or less, distance apart from each other than those of the first series, the same being for the purpose of increasing, or diminishing, the vibration of the seed dropper, so as to readily adapt the machine to drill, or to sow, in hills; the whole of the above being arranged and operating substantially as above specified.”

46. For an improvement in the mode of manufacturing *Coarse, or Alum, Salt by Steam*; Isaac Noyes, Kanawha Salines, Kanawha county, Virginia, April 25.

This is for an improvement on that method of making salt in which the salt water is first boiled, and reduced nearly to the point of saturation in large pans, and then drawn off from these pans into other vessels to deposite the salt, these depositing pans being double bottomed, and heated by the vapor arising from the boiling, or saturating, pans.

The patentee says, that “for the purpose of manufacturing coarse, or alum, salt, a uniform heat should be preserved throughout the granulating cistern, which cannot be done by the ordinary application of steam, by the use of metallic pipes.”

Claim.—“What I claim as my invention, is the pipe constructed in either of the methods herein described, part wood, and part metal, alternately, and passing through the cistern, either sinuous, or in a straight line from one end of the cistern to the other, one a conductor of heat, and the other a non-conductor; the one passing the heat to the brine, and the other retaining the heat, and passing the steam to the next metallic pipe, and so on to the end of the pipe;—whereby the heat is distributed alike to all parts of the brine, and its temperature preserved to a degree suited to the manufacture of coarse, or alum, salt, and equalized throughout the cistern. Any material which will produce the same result, may be used for the construction of the pipes; and boxes made of plank may be used instead of wooden pipe logs, but they are more liable to leak.”

47. For an improvement in the manner of governing the feed of a *Drill, or Borer, in a machine for drilling, or boring, Metal*; John R. Grout, Birmingham, Michigan, April 25.

On the stem of the drill, which has a screw cut upon it, there is a nut, and in the frame, in which the drill works, there is a plate of metal, called a friction piece, which can be pressed against the periphery of the nut by means of a thumb screw; when the friction piece is removed, and the nut is free to turn, the drill is not fed in, but when it is held tight by the friction piece, and prevented from turning, the feed of the drill, as it is turned, will be in proportion to the thread of the screw; and the greater, or less, pressure on the nut, allowing it to turn more, or less, will increase, or lessen, the feed.

Claim.—“What I claim therein as new, is the employment substantially in the manner, and under the combination herein made known, of a friction nut, and friction piece, so as to operate upon the mandril, or regulating, screw, or shaft, of a drilling, boring, or other machine, requiring a similar kind of feed; and this I claim whether such machine be made in either of the forms represented, or in any other, where the same principle may be applied by equivalent means.”

48. For an improvement in the mode of *Lettering Door Plates*; Edmund Morris, Philadelphia, Penna., April 25.

Each letter is cast, or otherwise made, on a separate block, and these blocks are so adapted to a door plate, or sign, on the door plate, &c., to the letters, that they can slide in, and then be retained in place, so that the same frame can answer for any combination of letters.

Claim.—“What I claim as my invention, is the manner of securing the letters in plates, or signs, so as to construct both of the latter out of movable type, or letters.”

49. For a mode of making *Fire Proof Ceilings for buildings*; Palmer Sumner, New York City, April 25.

The ceiling is rendered fire proof by means of metal laths made of plate, or sheet, metal, with the two edges bent over towards the middle, to form inclined ledges, which incline in opposite directions, to hold the plastering.

Claim.—“What I claim as my invention, is the method of constructing metallic laths either of iron, or any other suitable material; also the constructing of ceilings by running the laths diagonally across the room, so as to be least affected by the expansion, all of which is fully set forth in the specification and drawings.”

50. For an improvement in *Water-Wheels*; Albert Stimpson, Rockingham, Vermont, April 26.

The water is admitted to the wheel, (which is of the construction known under the appellation of the “center vent water-wheel,” the water being admitted to it through the outer periphery,) through a series of conductors arranged around it in the manner of Venetian blinds, and capable of adjustment, to regulate the quantity of water to be discharged. Below there is a discharging tail race provided

with a gate, which, when closed, floods the gate, to prevent freezing in cold weather.

Claim.—“What I claim as my invention, is the combination of the movable conductors with a gate in the tail race below the wheel, constructed and arranged in the manner and for the purpose set forth.”

51. For an improvement in the *Saw Cotton Gin*; John H. Sherard, Livingston, Sumpter county, Alabama, April 30.

Claim.—“What I claim as my invention, is connecting the revolving part of the grate with the other running parts of the machine, so as to cause its periphery to move in a contrary direction to the saws, and the addition of the cylindrical slow brush placed between, and in combination with the winged brush, and the saws. And lastly, I claim the grates placed above the bottom of the flues, in combination with the cotton gin for the purposes specified.”

The revolving part of the grates is a roller with a groove for, and into which, each saw runs, and placed above the saws. This device was patented by C. A. McPhetridge, on the 24th of April, 1841, and noticed at page 418, vol. iii, third series, of this Journal; and in this patent the claim is limited simply to the reversing of the direction of its motion, with the view of facilitating the separation of the fibres of cotton from the seeds. The cylindrical brush occupies the place of the winged brush generally employed in cotton gins for stripping the cotton from the saws, and moves much slower, and removes the cotton from the teeth without a current of wind, to permit dirt, &c., to fall through the grates below.

52 For improvements in the machine for separating *Garlic, and other impurities, from Wheat*; Elisha S. Snyder, Flowing Springs, Jefferson county, Virginia, April 30.

Claim.—“What I claim as my invention, is the manner of constructing the rubber, as set forth; that is to say, with a flexible armed band attached by screws to the cylinder, having packing inserted between the band and cylinder for increasing the diameter of the band, in order to compensate for the wear of the teeth, as described. I likewise claim constructing the stationary cylinder with grooves, and the top and bottom with ears, to rise and fall in said grooves, in the manner and for the purpose specified.”

The purpose of these improvements is to adjust the surfaces of the case and rubber to each other, which is deemed of importance in the separation of garlic.

53. For an improvement in *Cooking Stoves*; Peter Mills, Binghampton, Broome county, New York, April 30.

The nature of this improvement consists in placing over the fire chamber a double cylinder, having a flue between the inner and outer portion, and affixing thereto a swivel cover, the inner cylinder serving

the purpose of an oven, or as a recess, into which a boiler can be set, and the outer cylinder forming a space between the two, connected with the flues, and covered at top, for the circulation of heat around the oven so formed.

Claim.—“What I claim is the arrangement of the double cylinder, in combination with the flue spaces and damper, constructed and arranged in the manner and for the purpose specified.”

54. For an improvement in the *Truss for the cure of Hernia*; Epenetus A. Bennett, New York City, April 30.

The patentee says,—“I do not claim making the spring holding the pad, continuous with the main spring; but what I do claim as my invention, is the peculiar manner in which I form the spring arm, (to which the pad is attached,) by giving the main spring an abrupt spiral curve, at a point distant from the extremity of the (main part) spring, equal to the length of the required spring arm, and then continuing the said bent portion of the spring obliquely downwards, at an angle of about forty-five degrees, with a horizontal plane, or any required angle, forming a spring arm to which the pad is attached, producing the effect set forth.”

Patents Re-issued in the month of April, 1844.

1. For an improvement in the machine for *Cutting Shingles*, and other thin articles of wood; Jason C. Gillett, Bloomfield, Michigan, April 30.

This is a re-issue of a patent granted on the 20th of December, 1843, which will be noticed in this Journal in its order, in our list of arrears, and, therefore, we will simply give the amended claim of the re-issue.

Claim.—“I do hereby declare that I do not claim the use of a horizontal rotary wheel, or cutting knives, when taken alone; but what I do claim as my invention, is the manner in which I have arranged and combined the hoppers, or boxes, to receive the stuff to be cut, with the hammer levers, with the horizontal table, and with the knives attached thereto; said knives being so arranged, in the manner represented, as that one shingle, or other article, shall be cut by one knife before the other begins to operate; in the case of a shingle, the butt being cut by one knife towards the shaft, and by the other towards the periphery of the wheel.”

Patents for Designs which issued in the month of April, 1844, under the third section of the Act of August 29, 1842.

1. For a pattern, or combination of figures, to be worked into *Ingrain Carpeting*; Henry G. Thompson, New York City, April 4.

MECHANICS, PHYSICS, AND CHEMISTRY.

Application of Electricity to the improvement of the Manufacture of Iron.

"The attention of the iron masters has been attracted to a process of considerable importance, lately introduced into their manufacture. The application of electricity, to supersede several of the expensive processes, has, it is stated, been tried in the Welsh and Derbyshire furnaces with satisfactory results. It appears that the costly fuel and labor required for the purification of the ore from sulphur, phosphorus, and such subtle elements, create its high market value; and these being all electro-negative, have induced the new process, whereby the impure stream of metal, after flowing from the blast, is in its moment of consolidation subjected to a powerful voltaic battery, which so disengages the impure components, that in the process of puddling they are readily extracted. The London blacksmiths, it is stated, have tested this iron after a single reheating, and pronounce it equal to the best metal in the market. By the same process an experiment was tried by Dr. Ure, by whom a soft rod of iron was held in contact with a moderate red heat, and that gentleman is understood to have stated that in a few hours the metal was converted into steel. Should these facts prove what they seem, they are calculated to affect most seriously this important branch of our trade."—*Times*.

The process referred to in the above extract, is that for which Mr. Arthur Wall obtained a patent, Nov. 18, 1843. It is thus described in his specification, enrolled May 18, 1844:—

"In casting a bar, or similar mass, the electric current is caused to traverse from end to end, by conductors so arranged, that when the metal runs into the mould it may complete the electric circuit, or by means of a wire, or wires, passed from one end of the mould to the other. If the castings are horizontal, a piece of wrought-iron, or other conducting material, is placed at each end of the mould, which is made of sand, or other non-conducting substance; these conductors are then connected by wires with a galvanic apparatus, or voltaic pile, or electro-magnetic, or other battery; so that, when the melted iron is run into the mould, it will complete the electric circuit; and the patentee prefers to continue the electric current for some time after the iron has solidified. When the castings are vertical, a similar arrangement is made for the passage of the electric current through the metal, by placing a conductor at the top and bottom of the mould, in such a manner, that the electric circuit will be completed the moment the mould is filled with the liquid iron.

"To apply electricity to iron in a smelting furnace, or cupola, a wrought-iron rod is introduced through, or at the side of the tap-hole, until it comes in contact with the melting metal, and another wrought-iron rod is introduced at the upper and posterior part of the hearth, or through one of the tuyere holes, until it reaches the metal; the outer ends of these rods being then connected with a battery, the

electric current will be caused to pass through the iron; care being taken not to continue it so long as to entirely decarburate the iron, and bring it to a malleable state. When the electricity is to be applied to the iron in a puddling, or balling, furnace, two iron rods are also used; one of which is inserted into the fused metal, and the other end is connected with a battery; the other rod is attached to an insulating handle of porcelain, pottery, or other non-conducting substance, and a wire from the battery is connected to it, close to the handle. By means of the handle, the extremity of the rod is caused to traverse the iron in its melted state, or during its transition to the solid state, and the electric current will, therefore, pass through the metal in every possible direction."

Lond. Mechanics' Mag.

Coal Mines of France.

A geological survey of France has been in progress for nearly twenty years, under the care of two very able men, (Messrs. De Beaumont and Dufresnoy,) and was completed three or four years ago. These able and experienced observers examined the whole surface of the country, and the large geological map, which is the fruit of their labors, is now in the hands of the public. Their *Explication de la Carte Geologique*, will contain a complete account of the geology of the country; and the first volume, which was published in 1841, describes every portion of the *terrain houllier*, or coal formation, in great detail. Minute patches of that formation may have been overlooked, but we may be certain that no coal field worthy of notice for extent, can have escaped them. Whoever, therefore, desires full and authentic information respecting the coal mines of France, will find it in that volume, which is accompanied with a reduced geographical map of the kingdom, twenty-one inches square, beautifully and carefully colored. A simple inspection of that map, and a similar map of England, will satisfy any one of the comparatively small extent of coal in France. This is more distinctly set forth, however, in the seventh chapter of the volume, from which we borrow the following details:—

The coal fields of Scotland and England are estimated to occupy a twentieth part of the surface. The coal fields of France occupy only a two-hundredth part of the surface (*seulement un deux centième.*)

The country in Europe best supplied with coal, next to Britain, is Belgium, whose coal fields occupy a twenty-fourth part of the surface.

In France, coal of some description is widely diffused, being found in thirty-three out of the eighty-six departments; but most of the deposits are of trifling extent, and in many of them the coal is poor, or bad, in quality.

The coal basins of France have an extent of 692,000 English acres.

“ “ Britain, “ “ 4,900,000 “ “

All the coal mines of France produced only 29,447,000 metrical

quintals of coal, or 2,950,000 tons, in 1839—which is about a sixth, or seventh, part of the out-put of those of Britain. Of this quantity, 11,842,000 metrical quintals, or more than one-third, was furnished by the mines of St. Etienne, situated thirty-five miles south-west from Lyons. These mines are described as “the most important in the kingdom, from their extent, their position, and the excellent quality of the coal.” They extend over 68,000 acres, and communicate with Lyons and the Rhone by railway; yet, when we visited this part of France, in 1839, we found that the steamers plying between Lyons and Avignon used English coal,—which, we are told, cost 50s. per ton. The coal of St. Etienne must be worked under unfavorable circumstances, when English coal competes with it at such a price.

The French coal mines, when compared with those of England, lie under other disadvantages besides those already mentioned. Their situation is generally inland; and, of course, they are deficient in the means of cheap conveyance, which the sea affords. They are rarely accompanied with the iron ore, which, in England, so much increases their value for manufacturing purposes, and as rarely with the limestone, which serves as a flux to melt it.

Lond. Min. Journ.

Jeffery's Marine Glue as a preventive of fouling of Ships.

A naval correspondent of the “*Times*,” at Sheerness, states that the Speedwell tender to the Blazer, whose copper had been covered with Jeffery's marine glue mixed with corrosive sublimate, as a means of preserving her copper, and at the same time preventing fouling at sea, has been brought into dock, and the composition all stripped off, having been found a failure.

This was what every one competent to form an opinion must have foreseen. Jeffery's glue is *perfectly insoluble* in water; it is this property chiefly that constitutes its real value, as an uniting material; but the result of mixing any poisonous matter whatever with a perfectly insoluble resinous cement, is merely to envelope the poison in a water-tight covering, so that it is at once put out of the reach of affecting either animal, or plant; in fact, a piece of Jeffery's glue, mixed with corrosive sublimate, might be *chewed* in the mouth, or even so far as the poison was concerned, *swallowed* with perfect safety. To form a poisonous coating which shall prevent the fouling of a ship's sheathing, and, at the same time, prevent corrosion of the metal, whether copper, or iron, its composition, while fatty, or resinous, must be such, that it shall be slightly soluble in water, and so gradually liberate the poison to act on adherent animals, or plants. This is effectually done by Mr. Mallet's patent preparations, of which we gave an account in our 962nd Number, but can never be effected by admixture of poison with Jeffery's glue. Moreover, the poison to which Jeffery limits himself—corrosive sublimate—happens to be one of *the least* destructive of all inorganic poisons to the lower tribes of animals and plants.

Lond. Mechanics' Mag.

Artesian Well at Southampton.

In 1837, the important subject of the supply of water was brought more particularly under the attention of the inhabitants of this town, and at the desire of some of the more spirited and scientific residents, an experimental boring was made upon the common, at a distance of about two miles from the town, and at an elevated spot north of its site. This experiment indubitably proved that an unfailing supply of water could be procured in such unlimited quantity, as, it was hoped would enable it to be supplied to the inhabitants at a reasonable cost. In consequence, measures were immediately taken to sink a shaft. The works have now been in progress some years, and, as will be seen, the artesian well of Southampton is, though uncompleted, a work of the greatest magnitude, vying with, if it does not surpass, the great well of Grenelle, by which Paris has lately been supplied. The depth of the Southampton well is at present 1300 feet. The shaft descends through 78 feet of alluvium, 300 feet of clay similar to the London clay, which is a general substratum in the Southampton basin, and through another 100 feet of plastic clay, before it reaches the chalk, through which it descends 100 feet still further. Thus from the surface a well has absolutely been built downwards nearly 570 feet, and under such difficulties from irregularities in the strata, that four iron cylinders have been placed in points where no attempt at masonry could have proved successful. Not the least singular part of this work is the manner in which this underground well has been built from the summit level downwards, "into the very bowels of the land." This is a matter, however, which it would be tedious to describe; suffice it, therefore, to say, that after reaching nearly 600 feet, the operations of the masons were suspended, and the boring rods were brought into operation, and employed until, through their instrumentality, the contractors have reached a depth of 1300 feet. As might be expected, the supply of water is already abundant. It now rises to within 40 feet of the surface, and by the aid of powerful steam engines no less than 55,000 gallons a day are literally poured into the town of Southampton.

London Times.

New Patent Law in France.

The new French law relating to patents, has received the royal assent, and is officially promulgated in the *Moniteur*. By this law it is declared that new productions in manufactures, and the invention of new means in the application of known means for producing any result in any branch of industry, shall be considered as inventions, with the exception of financial plans, and pharmaceutical compounds. The patents are to endure for five, ten, or fifteen, years, and are to be taxed at the rate of 100*f.* per annum, for the period of duration. The consequence of neglecting to make one of these annual payments is the forfeiture of the patent. By the penal clauses which define the

rights of the patentee, it is enacted that all who infringe upon those rights shall pay a fine of from 100*l.* to 2000*l.*; and in case of a second offence, imprisonment for a term of from one to six months will be added to the fine. Foreigners are allowed to participate in the benefits of the law, and the author of an invention already patented abroad may obtain a patent in France, though it is specially enacted that the duration of this patent cannot exceed that of the patent previously taken out abroad. The law will come into operation in about three months, from which period all other laws relative to patents will be considered as repealed.

Lond. Min. Journ.

Death of Dr. Dalton.

We regret to learn the sudden death of that celebrated chemist and philosopher, the venerable Dr. Dalton, of Manchester, whose decease took place rather unexpectedly, but apparently without pain, at an early hour on Saturday morning last, in the 78th year of his age. His death is presumed to have been occasioned by paralysis, of which he had suffered three attacks since April, 1837. In him science has lost one of the greatest philosophers of his age, and humanity one of its brightest living examples. Dr. Dalton had been for more than half a century an active and invaluable member of the Literary and Philosophical Society of Manchester, having, together with his friend Dr. Edward Holme, M.D., F.L.S., been elected on the 25th of April, 1794. Indeed they were the oldest surviving members of the society, with the sole exception of Sir George Phillips, Bart., who became a member in 1785. Dr. Dalton had been president of this society since 1817. He was born at Eaglesfield, near Cockermouth, in Cumberland, on the 5th of September, 1766, of respectable parents, and gave early indications of mathematical ability. In 1781, he became a mathematical teacher in Kendal, from whence he contributed largely upon mathematical, philosophical, and general subjects, to the "Gentleman's," and "Lady's Diary." In 1788, he commenced his meteorological observations, which he continued throughout his life. In 1793, he was appointed Professor of Mathematics and Natural Philosophy in the New College, Mosley street, Manchester, and continued to hold his office until the college was finally removed to York. He was elected Fellow of the Royal Society in 1821, or 1822, and was also a member of the Royal Society of Edinburg, and of several foreign academies. In 1826, he was presented with a gold medal by the Royal Society, as the individual most eminent for his scientific discoveries. In 1833, a sum of 2000*l.* was raised for the erection of a statue to perpetuate his remembrance, and the task was entrusted to Sir Francis Chantrey, who brought to the execution of his subject a warm admiration of the man, and a proportionate desire to do him justice. The statue, when completed, was deposited in the entrance hall of the Royal Manchester Institution.

Lond. Mech. Mag. Aug. 3.

INDEX.

LIST OF AMERICAN PATENTS, WITH REMARKS, &c.

September, 1841.

		PAGE.
1. Rotary pump,	Samuel A. Lee,	178
2. Suspender strap,	D. B. Cook,	179
3. Lamps for lard, &c.,	George Carr,	ib.
4. Horse power,	M. Davenport,	180
5. Berths for vessels,	Harmon King,	ib.
6. Seamless hats, &c., of leather,	J. S. and W. Wibert,	181
7. Steam engines,	W. Witham,	ib.
8. Augur for artesian wells,	William Morris,	182
9. Supplying water to steam boilers,	John Hampson,	ib.
10. Shrinking, &c., hat bodies and cloth,	Henry A. Wells,	184
11. Supporting grates in stoves,	Gardiner Chilson,	ib.
12. Salting animal matters,	Charles Payne,	185
13. Window fastenings,	E. Robinson, and W. Hall,	248
14. Water-wheel for mills,	Jesse Taylor,	249
15. Cooking stove,	James Root,	ib.
16. Grinding mill,	Samuel Sheldon,	250
17. Collapsible vessels for paint, &c.,	John Rand,	ib.
18. Binding and confining tobacco,	Albert Snead,	251
19. Lamps for burning volatile oils,	Isaiah Jennings,	ib.
20. Felting fabrics of wool, fur, &c.,	Henry A. Wells,	252
21. Hardening felt fabric,	do. do.	ib.
22. Lamp for burning lard, &c.,	Moses S. Woodward,	ib.
23. Cooking stoves,	R. P. Putrick,	253
24. Steering boats,	Howard Nichols,	ib.
25. Carriage hubs and axles,	Henry F. Phillips,	254
26. Combination locks,	J. B. Gray,	ib.
27. Damask hair seating,	Samuel Ross,	ib.
29. Making potash,	Daniel B. Turner,	318
30. Pile driver,	R. N. Benson,	319
31. Prismatic pavements,	John Abbott,	ib.
32. Corn sheller,	P. Reading,	220
33. Transporting bales of cotton,	George R. Griffith,	ib.
34. Bee-hives,	Hiram A. Pitts,	321
35. Hot air furnace,	John A. Page,	ib.
36. Cleaning wheat,	Joseph Heygel,	322
37. Making bricks and tiles,	J. B. Wilson, and A. B. Crossman,	ib.
38. Planing timber,	Henry Law,	323
39. Wire heddles,	A. Howe, and S. S. Grannis,	324
40. Plough,	J. and H. F. Cromwell,	325
41. Sticking pins in paper,	Samuel Slocum,	ib.
42. Locks for doors, &c.,	Solomon Andrews,	ib.
43. Rolling and cutting dough for crackers,	Riley Darling,	326

January, 1844.

1. Lock for doors, combination,	Sabin Colton,	165
2. Spring scales, platform	G. R. Moore,	166
3. Weaving looms, regulating the delivery of yarn in	William H. Brayton,	ib.
4. Bee houses,	A. E. James,	ib.
5. Bricks, machine for moulding	J. Booth, and W. H. Stevenson,	167
6. Stoves, air-tight	John Cline,	ib.
7. Boots, shoes, &c., water-proof	W. J. Roome,	ib.
8. Flax and hemp breaker,	C. B. Butler,	168
9. Tuning pianos,	Joseph S. Ives,	ib.
10. Tobacco, preparing, for packing,	D. Smith,	ib.
11. Shaving shingles,	Simeon Wood,	169
12. Compound shovel plough,	Robert Nelson,	170
13. Cleaning grain,	M. Mallory,	ib.
14. Boat oars, making	B. and A. F. Potter,	ib.
15. Reverberatory furnace,	S. Broadmeadow,	171
16. Boot crimp,	J. Copeland, assigned to J. M. Reed,	ib.

17. Head and tail blocks for saw mills,	T. C. Theaker,	172
18. Setting logs on the carriage of saw mills,	John Miller,	173
19. Planting ploughs,	T. H. Hoskiogs,	ib.
20. Propelling boats,	G. Hippolyte,	ib.
21. Steam generators,	do.	174
22. Plough,	W. K. Allen,	175
23. Ointment for the cure of piles,	W. Wiltshire Riley,	ib.
24. Forging and swaging anvils,	John Taylor,	176
25. Filters for sugar works,	J. W. Chorley,	ib.
26. Carbonic paint,	J. Weisman,	ib.
27. Ships' blocks,	S. Waterman,	177

Re-issue.

1. Gun locks,	Ethan Allen,	177
---------------	--------------	-----

Additions to former Patents.

1. Breaking and screening coal,	Joseph Battin,	177
<i>February, 1844.</i>		
1. Washing machine	James B. Coffin,	232
2. Wheat fan for cleaning grain,	David Watkins,	ib.
3. Propelling canal boats,	H. R. Worthington,	ib.
4. Roller gin for cotton,	R. Reynolds, jr,	233
5. Vibrating steam engine,	E. A. Lester,	ib.
6. Flask for moulding hinges,	Thomas Loring,	234
7. Hanging sliding doors,	W. T. Forsyth,	ib.
8. Rotary steam engine,	Abram Pease,	ib.
9. Cooking stoves,	J. Young, and E. Parker,	235
10. Straw cutter,	W. Hovey,	ib.
11. Cooking stoves,	J. L. Mott,	236
12. ———,	Simon Pettes,	ib.
13. Corn Mill,	G. T. Walters,	237
14. Moulds for butt hinges,	B. F. Harley, and J. W. Morris,	ib.
15. Stocking loom,	R. Walker, and J. McIntire,	ib.
16. Balance valve for steam engines	T. McDonough,	238
17. Breaking coal,	Joseph Battin,	ib.
18. Opening and closing bee hives,	S. and J. D. Cope,	239
19. Buckle for straps, braces, &c.	J. W. Hatch,	240
20. Cooking stoves,	S. S. Jones,	ib.
21. Digging potatoes,	A. C. Ketchum,	ib.
22. Glazing for earthen ware,	T. and E. Parker,	241
23. Cutting straw, &c.,	H. M. Smith,	ib.
24. Coupling bars for railroad cars, &c.,	W. D. Chesnut,	ib.
25. Lever power for pressing, &c.,	R. Sanderson,	242
26. Cooking stove and baker,	A. Hotchkiss,	ib.
27. Horizontal paddle-wheel,	P. Lear, and E. Buck,	ib.
28. Combined water-wheel,	E. G. Covel,	243
29. Preventing accidents in railroad cars,	Elisha Tolles,	ib.
30. Laying ropes, &c.,	S. and J. A. Bazin,	244
31. Preparing hemp, &c., for spinning,	W. Montgomery,	ib.
32. Coloring hair,	A. Grandjean,	245
33. Oil feeder,	Joseph Benson,	ib.
34. Smut machine,	J. W. Brower,	246
35. Digging trenches, &c.,	E. Cornell,	ib.
36. Railroad cars for turning curves,	John H. Quail,	247
37. Cleaning cutlery,	William Vine,	ib.
38. Rotary inclined propeller,	Richard F. Loper,	248
39. Churn,	George W. Cook,	ib.

For Designs.

A bust of Robert Burns,	John C. King,	248
Ornaments to surround stoves,	J. L. Mott,	ib.

March, 1844.

1. India rubber goods,	Charles Goodyear,	295
2. Corrugated goods,	do. do.	ib.
3. Lining metal boxes,	Moses Palmer,	296
4. Press for lifting weight,	Smith Cram,	ib.

5. Plough, ...	Israel Long, ...	296
6. Cotton Press, ...	George Peck, ...	297
7. Lamps, ...	Samuel Rust, ...	ib.
8. Mill for grinding grain, ...	Erastus Arnold, ...	298
9. Folding and measuring cloth, ...	S. C. Durgin, ...	ib.
10. Cooking stoves, ...	Samuel Bents, ...	ib.
11. Buckles, ...	I. B. Verplank, ...	299
12. Washing machine, ...	Ephraim Lukens, ...	ib.
13. Setting evaporating kettles, ...	Abraham Hager, ...	300
14. Mould boards for ploughs, ...	Henry Brown, ...	ib.
15. Lead pipes, ...	C. and G. E. Sellers, ...	ib.
16. Propeller for steam ships, ...	Ralph Bulkley, ...	301
17. Pressing hats and bonnets, ...	Caleb Merritt, ...	ib.
18. Gathering fruit, apparatus for	A. McWilliams, ...	302
19. Grinding grain, ...	Eli B. Nichols, ...	ib.
20. Exercise to dyspeptics, &c., ...	Oliver Halsted, ...	303
21. Cutting boots, ...	T. Cranage, ...	ib.
22. Rake for grain, ...	B. F. Partridge, ...	304
23. Brooms, machine for making	J. H. Hinton, ...	ib.
24. Fastening the saddle of a harness, ...	Abel B. Buell, ...	ib.
25. Artificial teeth, ...	J. Smith Dodge, ...	305
26. Label for mail bags, ...	Oren S. North, ...	ib.
27. Brushing and winding cloth, ...	R. C. Varnel, ...	ib.
28. Regulating the burning of alcohol, &c., ...	L. E. Hicks, assigned to G. L. F. Griswold, ...	ib.
29. Cotton Press, ...	Seth Lamb, ...	306
30. Harpoon, ...	Albert Moor, ...	ib.
31. Portable furnace, ...	George E. Waring, ...	307
32. Stoves for cooking, &c., ...	John Woolley, ...	ib.
33. Lock gates for canals, ...	Henry McCarty, ...	308
34. Circular saws, ...	John K. Mayo, ...	ib.
35. Cutting shingles, ...	William Wood, ...	ib.
36. Door plates, ...	J. H. Grout, and F. M. Ray, ...	309
37. Thrashing and cleaning grain, ...	L. and E. Whitman, jr., ...	ib.
38. Truss for the cure of hernia, ...	David Sabins, ...	ib.
39. Cleaning grain, ...	James M. Clarke, ...	310
40. Lamp caps, ...	Francis Draper, ...	ib.
41. Kitchen ranges and grates, ...	A. W. Thompson, ...	311
42. Water-wheel, ...	H. Ferguson, ...	ib.
43. Press for cotton, &c., ...	P. G. Gardiner, ...	ib.
44. Piano fortes, ...	O. Gori and P. Ernst, ...	312
45. Mill bushes, ...	John Heck, ...	313
46. Refrigerator, ...	David Evans, ...	ib.
47. Roofing with tin, ...	John Woolley, ...	ib.
48. Stoves for heating, &c., ...	L. Bailey, ...	ib.
49. Cutting sausage meat, ...	William Pittenger, ...	314
50. Water-wheel, ...	N. Johnson, ...	ib.
51. Weavers' temples, ...	Isaac C. Lane, ...	ib.
52. Hooks and eyes, ...	E. C. Savage, ...	315
53. Lamp for burning lard, &c., ...	John Lobin, ...	ib.
54. Composition for aqueducts, ...	Gideon Myers, ...	ib.
55. Heating apparatus, ...	John Smart, ...	316
56. Cleaning wool and cotton, ...	Silas G. Mumford, ...	ib.
57. Making bricks, ...	N. J. Wyeth, ...	317

Re-issue.

Preparing and spinning flax and hemp,

Moses Day, ... ib.

Additions to former Patents.

1. Hand bench plane, ...	William Foster, ...	ib.
2. Cooking stove, ...	Daniel Williams, ...	ib.

For Designs.

Design for floor oil cloth, ... Jacob D. Edwards, ... 318

April, 1844.

1. Protecting metallic reflectors, ...	Alonzo Farrar, ...	408
--	--------------------------	-----

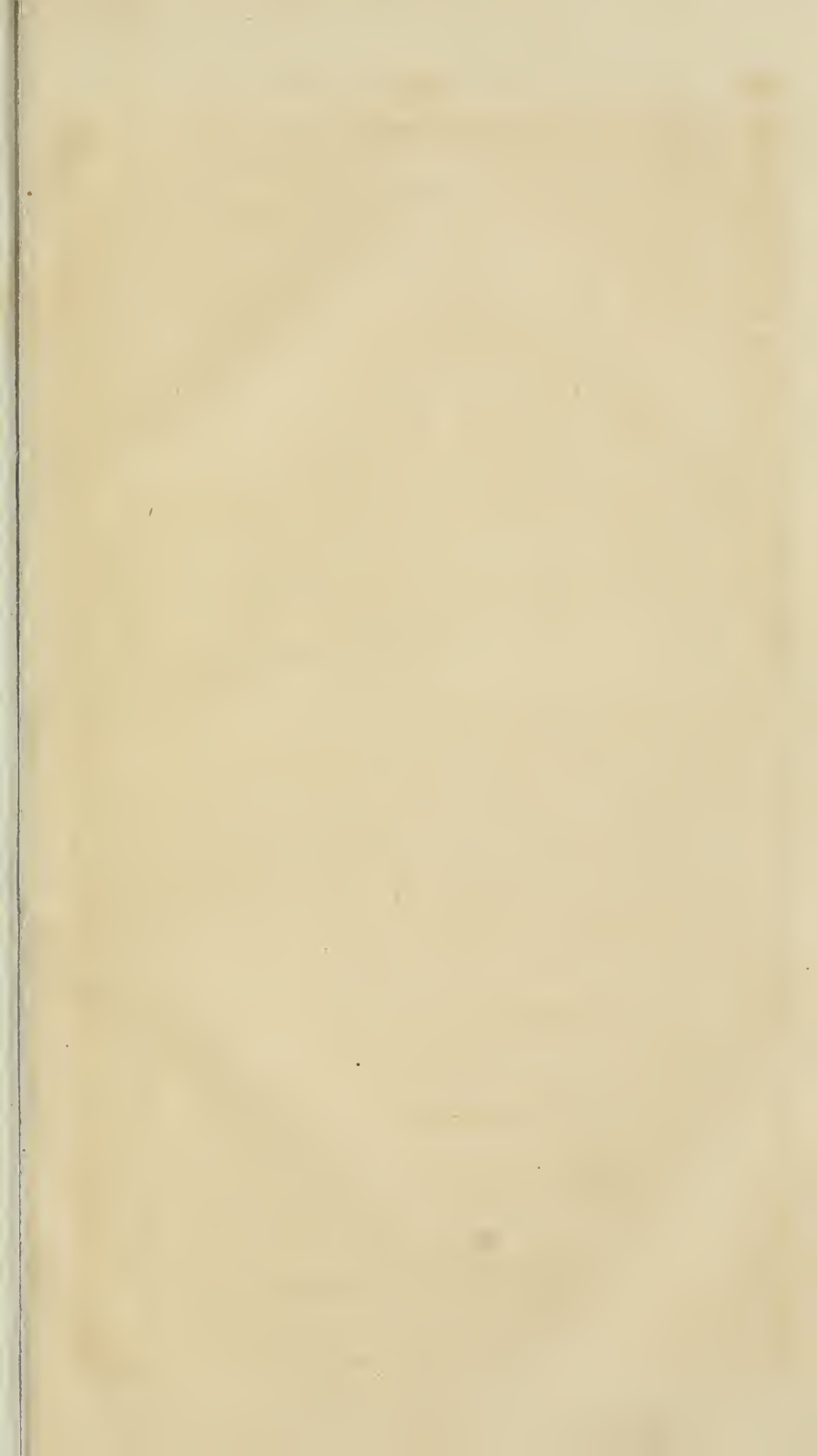
2. Cooking Stove, ...	Roswell Bush, ...	408
3. Washing machine, ...	L. Woodward, ...	409
4. Cotton gin, ...	Eleazer Carver, ...	ib.
5. Fitting ladies' dresses, ...	S. S. Richardson, ...	410
6. Frames of bridges, ...	T. W. and C. Pratt, ...	ib.
7. Corn mills, ...	Samuel L. Herr, ...	ib.
8. Cotton seed planter, ...	Dierck Brewer, ...	411
9. Cooking stoves, ...	Abner Leland, ...	ib.
10. Connecting carriage body with the perch, ...	George Nichols, ...	ib.
11. Dressing stone, ...	Hammond Ward, ...	412
12. Pump, ...	T. J. Wolfe, ...	ib.
13. Current water power, ...	John Carnegy, ...	ib.
14. Clocks, ...	F. Kesselmeier, ...	413
15. Smut machine, ...	S. Scammon, and R. Nason, ...	ib.
16. Cooking Range, ...	Julius Fink, ...	414
17. Liverwort candy, ...	H. and G. Garrison, ...	ib.
18. Cooking stove, ...	F. Kesselmeier, ...	415
19. Whipple trees, ...	James S. Shuell, ...	ib.
20. Cupping apparatus, ...	Robert J. Dodd, ...	ib.
21. Plough for ditching, ...	James Herbert, ...	416
22. Rails for railroads, ...	James M. Bay, ...	ib.
23. Corn sheller, ...	William McCall, ...	417
24. Splitting leather for harness, ...	Alpha Richardson, ...	ib.
25. Wrought-iron ploughs, ...	John Thompson, ...	418
26. Locks for safes, vaults, &c., ...	M. R. Stevenson, and O. Edwards, ...	ib.
27. Sealing wax and phosphorus, ...	John Fa'man, ...	419
28. Regulating changes of temperature, ...	Samuel D. Tillman, ...	ib.
29. Locks for safes, vaults, &c., ...	M. R. Stephenson, and O. Edwards, ...	ib.
30. Sails for vessels, cutting, &c., ...	Warren C. Choate, ...	420
31. Æolian attachment for pianos, ...	O. M. Coleman, ...	ib.
32. Washing machine, ...	W. Newbrough, ...	421
33. Inking forms of printing presses, ...	Richard M. Hoe, ...	ib.
34. Cylinder printing press, ...	do. do. . . .	ib.
35. Steam valve, ...	Sprague Barber, ...	422
36. Spinning rovings, ...	Phineas Stevens, ...	ib.
37. Bee house, ...	George R. West, ...	423
38. Furnaces for steam boilers, ...	Peter Robinson, ...	ib.
39. Churns, ...	H. Bently, ...	ib.
40. Caulking seams of ships, &c., ...	William Bennett, ...	424
41. Cleaning grain, ...	C. W. Cathcart, ...	ib.
42. Suspender buckles, &c., ...	Henry Dubosq, ...	ib.
43. Fastening tin, &c., for roofs, ...	Peter Naylor, ...	425
44. Hay press, ...	Charles F. Paine, ...	ib.
45. Seed drill and planter, ...	Loea Pratt, ...	ib.
46. Making salt by steam, ...	Isaac Noyes, ...	426
47. Governing the feed of drills for metal, ...	John R. Grout, ...	ib.
48. Lettering door plates, ...	Edmund Morris, ...	427
49. Fire proof ceilings, ...	Palmer Sumner, ...	ib.
50. Water-wheels, ...	Albert Stimpson, ...	ib.
51. Saw cotton gin, ...	John H. Sherard, ...	428
52. Separating garlic, &c., from wheat, ...	Elisha S. Snyder, ...	ib.
53. Cooking stove, ...	Peter Mills, ...	ib.
54. Truss for the cure of hernia, ...	E. A. Bennett, ...	429
<i>Re-issue.</i>		
1. Cutting shingles, &c., ...	Jason C. Gillett, ...	ib.
<i>For Designs.</i>		
Figure for ingrain carpeting, ...	H. G. Thompson	ib.
Amsterdam to Rotterdam, Account of railway from		18
Analysis of carbonates, Apparatus for the		354
Angles, On the reduction of inclined to horizontal		230
Arches, Remarks on the theory of		226
Artesian well of Southampton, ...		433
Artificial horizon, The pendulum marine		70

Atmospheric railway, Description of the, by J. Samuda,	105
———, Application of the	157
———, J. Leonard's report on the	361
———, R. Stephenson's opinion of the	293
———, Working expenses of the	13
Axles, Breaking of railway	101
———, Experiments on the strength of hollow and solid	163
Bakewell, T. W., Remarks on long and short connecting rods,	107
Bank notes, &c., Preparing paper for— <i>patent</i> ,	186
Batchelder, J. M., Remarks on the explosion of hardened steel,	133
Belts, Morin on transmitting motion by	22
Blast furnace Hearth,	203
Blasting by electricity,	17
Boilers, Incrustation of steam	137
———, On preventing the foaming in steam	135
Brake, or friction dynamometer, Observations on De Prony's	155
Brazil, The Diamond mines of	72
Bricks, tiles, retorts, &c., Drying— <i>patent</i> ,	112
Bridge over the Danube, Suspension	370
Bronze used by the Chinese,	356
Calotype Process of photography,	43
Canals, New mode of traction on	294
———, Steam traction on	112
Carbonates, Apparatus for the analysis of	354
Caspian sea, Level of the	294
Cast-iron light house for the island of Bermuda,	111
Cementing, or gluing, New method of— <i>patent</i> ,	356
Chinese bronze,	ib.
Chimney one hundred and twenty feet high, Method employed for repairing a	103
Chlorides of gold,	286
Civil Engineers, Proceedings of the Institution of	18, 86, 101, 157, 226, 258
Clocks used in observatories, On loud beats of	281
Cloth, On fixing color in— <i>patent</i> ,	19
Coal gas, Purifying	159
Coal mines of France,	431
Colors in homogeneous bodies, Prismatic	105
Combustion of coal,	160
Compensating pendulum, Triangular	134
Connecting rods, Bakewell's remarks on long and short	107
Copper mining in Cornwall,	223
——— ores, Captain Hughes' report on working	31, 124, 194, 261
Cornish engines, Captain Hughes' report on	161
Cotton fabrics, Water proofing— <i>patent</i> ,	358
Crystals of salt, Means of preserving the	283
Cutting, or shearing, iron— <i>patent</i> ,	358
Cuttings, Constructions to retain the sides of deep	162
Cylinders, Method of tracing spirals on the surface of	353
Daguerreotype process, Improvements in the	287
Dalton, Death of Dr.	434
Danube, Suspension bridge over the	370
Deep cuttings, Constructions to retain the sides of	162
Diamond mines of Brazil,	72
Dipleidoscope, The	341
Dock gate at Montrose harbor, Description of the iron	105
Dynamometer, On De Prony's brake, or friction,	155
Easter day in 1845, Notice of	351
Egypt, Pyramids of	6, 81
Electric machine, Portable hydro-	68
——— printing telegraph, Bain's	61
Electricity, Blasting by	17
Electricity in the manufacture of iron, Application of	430
Emory, Lieutenant, Screw pile piers proposed by	1
Energatype, a new photographic process,	283

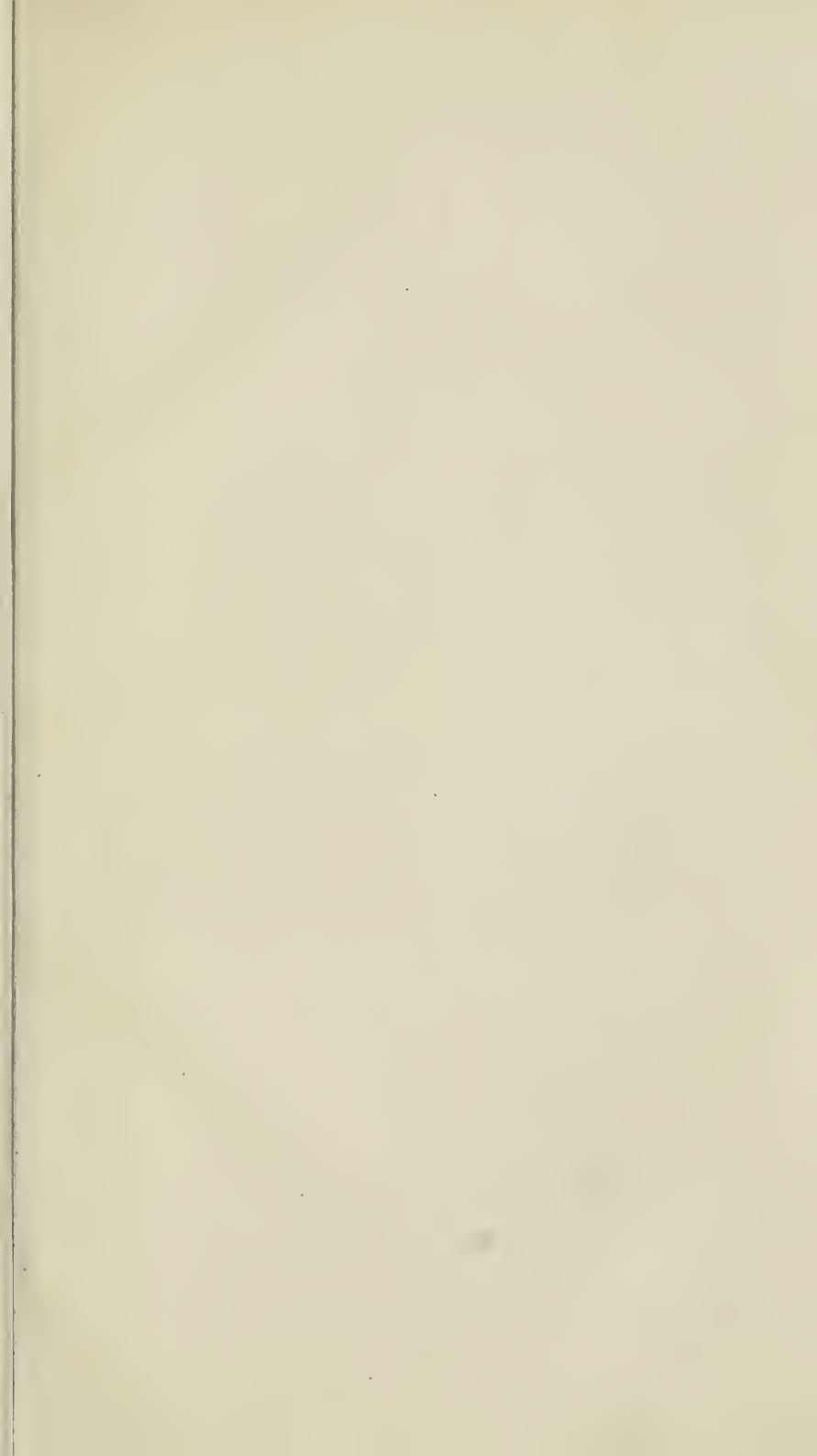
Explosion of the gun on board the steam frigate Princeton,	206
— hardened steel,	133
Felted fabrics, Deposition of metal upon— <i>patent</i> ,	260
Fire, Supply of water in case of	160
Foaming in steam boilers, On preventing the	135
France, Coal mines of	431
—, New patent law of	433
—, Steam communication with	355
Friction dynamometer, On De Prony's brake, or	155
Fuel in locomotives on the Liverpool and Manchester railway, Consumption of	367
Furnace for converting ore into iron— <i>patent</i> ,	117
— smelting iron— <i>patent</i> ,	255
— making malleable iron from the ore— <i>patent</i> ,	119
— hearth, Improved blast	203
FRANKLIN INSTITUTE,	
Committee on Science and the Arts.	
Report on the explosion of the gun on board the steam frigate Princeton,	206
Committee on Exhibitions.	
Address on awarding premiums of the 14th exhibition, by J. Wiegand, Esq., chair.	372
Report of the committee awarding the premiums, &c., of the 14th exhibition,	375
Gas, On purifying coal	159
Glass, Coating with silver,	193
—, Improvement in the manufacture of— <i>patent</i> ,	114
Glue, to prevent fouling of ships, Marine	432
Gluing, or cementing, A new method of— <i>patent</i> ,	356
Gold, Chlorides of	286
— paint, Bessemer's patent	349
— recently discovered in the Ural,	66
Gun, Explosion of, on board the steam frigate Princeton,	206
Guns, Report of Committee on Naval Affairs on large wrought-iron	326
Hearth, Improved blast furnace	203
Homogeneous bodies, Prismatic colors in	105
Horizon, The pendulum marine artificial	70
Hughes, Captain, Report on working copper ores	21, 124, 194, 261
Hydro-electric machine,	68
Ice fender at Newcastle, Screw pile pier for	1
Incrustation of steam boilers,	137
Iron, Application of electricity to the manufacture of	430
—, Cutting, or shearing— <i>patent</i>	358
— directly from the ore, Making malleable— <i>patent</i> ,	119
— dock gate at Montrose harbor, description of the	105
—, Furnace for converting ore into wrought— <i>patent</i> ,	117
— — — — —, <i>patent</i> ,	255
— guns, Report of the Committee on Naval Affairs on large wrought	326
— light house for the island of Bermuda, Cast	111
— steam vessel, Wrecking of an	137
—, Oxidation of	99
Lamp, Description of a new safety	351
Leveling instrument, Description of an improved	217, 289
Life preserver, Stephen's	71
Light house, Description of the Wyre	3
— for the island of Bermuda, Cast-iron	111
— — — — —, Removal of the Sunderland	161
Lights, Robeson's patent signal	344
Limestone, On the magnesian	110
Litrometer, Description of the	28
Liverpool and Manchester railway, Consumption of fuel in locomotives on the	367
Liverpool screw, Experiments with a vessel called the	86
Locomotive expansive apparatus, Parson's	65
Lunar occultations,	72, 216, 288, 360
Magnesian lime-stone, On the	110
Magnetic ores of Samakoff, Reduction of the	103

Malleable iron directly from the ore, Making— <i>patent</i> ,	119
Marine artificial horizon, The pendulum	70
Marine glue to prevent fouling of ships,	432
Metallic sand,	65
Metals upon felted fabrics, Deposition of— <i>patent</i> ,	260
Mineral and metallic statistics,	221
Miners, Description of a machine for raising and lowering	16
Mines of Brazil, The diamond	72
Mining in Cornwall, Copper	223
Morin on transmitting motion by belts,	22
Morris' remarks on water-wheels, Observations on	73
Obelisk at the Cape of Good Hope, Account of the erection of the Herschel	281
Observatories, On loud beat of clocks used in	280
Occultations, lunar	72, 216, 288, 360
Ores, Captain Hughes' report on working copper	31, 124, 194
— of Samakoff, Reduction of the magnetic	103
— tin, Reduction to a metallic state of	196
Oxidation of iron,	99
Paint, Bessemer's patent gold	349
Paper designed for bank notes, &c., Preparing— <i>patent</i> ,	186
Parson's locomotive expansive apparatus,	65
Patent law of France, new	433
Patents expired in 1843, List of American	137
Pendulum, Compensating	277, 278
—, Description of a self-registering	347
—, marine artificial horizon	70
—, Triangular compensating	134
Photographic process,	283
Photography, Calotype process of	43
Pier for ice fender at Newcastle, Screw pile	1
Piers of Sarclet harbor, Rebuilding the	162
Platina in the sands of the Rhine,	72
Porcelain, Introduction of, into France,	58
Preserving timber,	102
Printing telegraph, Bain's electric	61
Prismatic colors in homogeneous bodies,	105
Propellers, Experiments on screw	86
—, Remarks on screw	145
Public works in Paris,	112
Puddling furnace for making malleable iron— <i>patent</i> ,	119
Pump valves,	268
Pyramids of Egypt,	6, 81
Railway, Application of the atmospheric	155
— axles, Breaking of	101
—, Experiments on the strength of hollow and solid	163
—, Consumption of fuel in locomotives on the Liverpool and Manchester	367
—, Description by J. Samuda of the atmospheric	105
— from Amsterdam to Rotterdam, Account of the	18
—, J. Leonard's report on the atmospheric	361
—, R. Stephenson's opinion of the atmospheric	293
— wheels, Apparatus for lessening the vibration, &c., of	291
—, Working expenses of the atmospheric	13
Railways, Slips in cuttings and embankments of	18
Reverberatory furnace for converting ore into wrought-iron— <i>patent</i> ,	117
Rhine, Platina in the sands of the	72
Rods, T. W. Bakewell's remarks on long and short connecting	107
Ropes, Patent wire	85
—, Utility of wire	15
Safety lamp, Description of a new	381
Salts, Means of preserving the crystals of	285
Sand, Metallic	65
Sarclet harbor, Rebuilding the piers of	162

Scaffolding for constructing and repairing columns, &c.,	102
— used in erecting the Nelson column,	ib.
Screw pile pier for ice fenders at Newcastle,	1
— propellers, Experiments with	86
—, Remarks on	145
Sea, Modes of measuring the depths of the	69
Self-registering pendulum, description of a	347
Shearing, or cutting, iron— <i>patent</i> ,	358
Signal lights, Robeson's patent	344
Silver, Change in the molecular structure of	203
—, Coating glass with— <i>patent</i> ,	193
Spectroscope, for exhibiting supernatural appearances,	346
Spirals on the surface of cylinders, method of tracing	353
Statistics, Mineral and metallic	221
Steam boilers, Incrustation of	137
—, On preventing the foaming in	135
— communication with France,	355
— frigate Princeton, Explosion of the gun on board of the	206
— traction on canals,	112
— vessel, Wrecking of an iron	136
Steel, Explosion of hardened	133
— making, Account of	52
—, Manufacture of— <i>patent</i> ,	122
Stephenson, George, C. E., account of himself,	370
Storm glass, Description of the	179
Sunderland light house, Removal of the	161
Suspension bridge over the Danube,	370
<i>Specification of Patents.</i>	
Bricks, tiles, retorts, &c., Drying— <i>Ainslie's</i> ,	112
Coating glass with silver— <i>Drayton's</i> ,	193
Cutting iron— <i>Gladstone's</i> ,	358
Deposition of metals on felted fabrics— <i>Schottländer's</i> ,	260
Fixing color in cloth— <i>Robin's</i> ,	19
Furnaces, or fire places— <i>Detmold's</i> ,	255
Glass, Manufacture of— <i>Hartley's</i> ,	114
Gluing, New method of— <i>Austin's</i> ,	356
Malleable iron, Manufacturing— <i>Broadmeadow's</i> ,	119
Paper designed for bank notes, &c., Preparing— <i>Newton's</i> ,	186
Reverberatory furnace— <i>Broadmeadow's</i> ,	117
Steel, Manufacturing of	122
Water proofing cotton fabrics— <i>Townsend's</i> ,	358
Whalebone, Substitute for— <i>Davidge's</i> ,	21
Telegraph, Bain's electric printing	61
Timber, Preserving	102
Tin ores, Reduction of, to a metallic state,	196
Traction on canals, New mode of	294
— by steam,	112
Transit instrument, The diploidoscope	341
Valves, On pump	268
Vibration, &c., of railway wheels, On lessening the	291
Water in case of fire, Supply of	160
— proofing cotton fabrics— <i>patent</i> ,	358
— wheels, Observations on Morris' remarks on	73
Whalebone, Substitute for	21
Wire ropes, Patent	85
—, Utility of	15
Wrought-iron, Furnace for converting ore into— <i>patent</i> ,	117
— guns, Report of the Committee on Naval Affairs on large	326
Wyre light house, Description of the	3









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